

**Early Childhood Practitioners experience of the  
Mathematical Literacy curriculum in the context of the  
National Certificate in Early Childhood Development:  
A Case Study**

**by**

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Master of Education (Social Justice) in the School of Education, University  
of KwaZulu Natal.**

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## DECLARATION

I declare that this is my own work. It has been submitted in partial fulfillment of the requirements for the Degree of Master in Education (Social Justice) in the School of Education at the University of KwaZulu-Natal. It has not been submitted before for any degree or examination in this or any other university.

**Padmini Patsy Pillay**



Date 28/02/05

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## **ABSTRACT**

Since 2002, the South African Qualifications Authority (SAQA) has included mathematical literacy as a compulsory fundamental component for the Further Education and Training Certificate (FETC). This constituted a radical development in education and is intended to empower individuals so that they can function effectively in, and contribute to the democratization of the country. This exploratory study examined the mathematical literacy experiences of 12 Early Childhood Development (ECD) practitioners training toward the National Certificate in ECD at NQF L4. The study was conducted at a non-government, non-formal ECD training organization based in Durban. The practitioners were undertaking their training as part of a Learnership programme. A qualitative research methodology was employed. The data was gathered through focus group interviews, semi-structured interviews, and documentary analysis. The study revealed that the practitioners held a positive view of mathematical literacy training. In addition, it was found that such training should remain as part of the ECD qualification owing to the fact that it added value at both a personal and professional level. In interrogating the curriculum, practitioners recommended the inclusion of ECD examples, and engagement with how mathematical literacy is used in the different contexts. In terms of relevancy of content, practitioners recommended content areas that could be applied in their personal and professional lives. Mathematical literacy that related to national issues was seen as abstract, for example balance of payment in terms of the national budget. The study revealed that the background of the ECD practitioners need to be taken into account as some practitioners may not have studied mathematics before. This implies that providers will need to take into account the NQF Level 3 entry requirements and the expected embedded knowledge that practitioners are supposed to have prior to the registration of practitioners for the NQF L 4 certificate. In this regard, policy makers may also need to re-examine the issue of whether mathematical literacy is needed at the level of the qualification. Dialogue on these issues between SAQA and the different stakeholders may be necessary. Not surprisingly, the study revealed the need for suitably trained mathematical literacy facilitators given that this is a new programme. This study is by no means exhaustive, and is but a small sample of views that could be further explored in a more comprehensive study.

## **Acronyms and Abbreviations**

ABET	Adult Basic Education and Training
DoE	Department of Education
DoL	Department of Labour
ECD	Early Childhood Development
ETDP	Education, Training and Development Practices
ETQA	Education and Training Quality Assurance
FET	Further Education and Training
NLRD	National Learner Record Database
NSB	National Standards Body
NSF	National Skills Fund
NQF	National Qualifications Framework
PoE	Portfolio of Evidence
RPL	Recognition of Prior Learning
SACECD	South African Congress for ECD
SAQA	South African Qualifications Authority
SATIECD	South African Training Institution for ECD
SETA	Sector Education and Training Authority
SGB	Standards Generating Body
WSP	Workplace Skills Plan

## Glossary

**Accreditation** means the certification, usually for a particular period of time, of a person, a body or an institution as having the capacity to fulfill a particular function in the quality assurance system set up by the South African Qualifications Authority in terms of the (SAQA) Act.

**Applied competence** means the ability to put into practice in the relevant context the learning outcomes acquired in obtaining a qualification.

**Assessor** means the person who is registered by the relevant Education and Training Qualifications Assurance body in accordance with criteria established for this purpose by a Standards Generating Body, to measure the achievement of specified National Qualifications Framework standards and qualifications.

**Critical outcomes** means those generic outcomes that inform all teaching and learning.

**Education and Training Quality Assurance body (ETQA)** means a body accredited in terms of section 5(1) (a) (ii) of the (SAQA) Act. The body is responsible for monitoring and auditing achievements in terms of national standards and qualifications and to which specific functions relating to the monitoring and auditing of national standards and qualifications have been assigned in terms of section 5 (1) (b) (i) of the (SAQA) Act.

**Exit level outcomes** means the outcomes to be achieved by a qualifying learner at the point at which he or she leaves the programme leading to the qualification.

**Integrated assessment** refers to that form of assessment that permits the learner to demonstrate applied competence and which uses a range of formative and summative assessment methods.

**Learning Programme** means the sequential learning activities, associated with curriculum implementation, leading to the achievement of a particular qualification or part qualification.

**National Standard Body ((NSB)** refers to a body registered in terms of section 5 (1) (a) (ii) of the (SAQA) Act. The body is responsible for establishing education and training standards or qualifications, and to which specific functions relating to the registration of national standards and qualifications have been assigned in terms of section 5 (1) (b) (i) of the (SAQA) Act.

**Outcomes** means the contextually demonstrated end products of the learning process.

**Qualifications** means a planned combination of learning outcomes which has a defined purpose or purposes, and which is intended to provide qualifying learners with applied competence and a basis for further learning; and it means the formal recognition of the achievement of the required number and range of credits and such other requirements at specific levels of the NQF as may be determined by the relevant bodies registered for such purpose by the SAQA (NSB regulations).

**Standard Generating Body (SGB)** refers to a body registered in terms of section 5 (1) (a) (ii) of the (SAQA) Act. The body is responsible for establishing education and training standards or qualifications, and to which specific functions relating to the establishment of national standards and qualifications have been assigned in terms of section 5 (1) (b) (i) of the ((SAQA) Act.

**Unit Standard** means registered statements of desired education and training outcomes and their associated assessment criteria together with administrative and other information as specified in these regulations. (NSB regulations).

*The glossary is extracted from SAQA's FETC Policy (2001a) and The National Qualifications Framework and Curriculum Development. (2000).*

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## **CHAPTER 1: INTRODUCTION**

### **1.1 INTRODUCTION**

Early Childhood Development (ECD) in South Africa is an 'umbrella term that refers to the process by which children from birth to at least nine years grow and thrive, physically, socially, emotionally, spiritually, mentally and morally' (Department of Education, 2001: 14). Prior to 1994, there was no Government support for ECD services for black children in this age group, that is, younger than the compulsory school going age. Communities through community based organizations (CBO's) assumed this responsibility. Training of caregivers, now referred to as practitioners, was largely organized through Non Governmental Organizations (NGO's), and referred to as Resource and Training Organizations (RTO's).

There was no common framework for the training of ECD practitioners in South Africa. The following documents and Projects were relevant to standards setting for ECD practitioners prior to 1994 according to Short (1997):

- The SATIECE (South African Training Institute for Early Childhood Educare) guidelines for accrediting non-formal training courses for ECD practitioners, which were used for the accreditation of training providers.
- The interim accreditation guidelines for ECD practitioners contained in the Interim Policy for Early Childhood Development.
- The COTEP (Committee for Teacher Education Policy) Norms and Standards for Teacher Education (1996) was accepted as national policy for tertiary teacher education institutions.

The National ECD Pilot Project was implemented by the Department of Education (DoE) and was one of the first projects to test models on provisioning, training and curriculum. The interim core and elective unit standards developed by the Interim Accreditation Committee (IAC) was used in the training of practitioners by RTO's.

Post 1994 saw the passing of the South African Qualifications Act, 1995 (ACT No.58 of 1995) by Parliament, aimed at designing a national learning system. The Act established the South African Qualifications Authority (SAQA) as a statutory body responsible for the development and implementation of the National Qualifications Framework (NQF). In 2000 the Standards Generating Body (SGB) for ECD was established to generate standards and qualifications from Level 1 to Level 5 and used the interim standards developed by the IAC to a large extent (SAQA, 2002b).

In 2002, the Further Education and Training Certificate (FETC) Policy, Section 9 (1) noted that for the registration of a L 4 qualification, a minimum of 72 credits is required at or above the level at which the Certificate is awarded. This had to include fundamental learning, of which at least 20 credits were to be from the field of Communication Studies and Language, and in addition at least 16 credits from Mathematics (SAQA, 2002a:).

The FETC Policy emphasizes that the learning outcomes and associated assessment criteria must be of the level required by the learner to participate effectively in society, and the outcomes should be possible to achieve in various contexts, and should not pose an unnecessary barrier to learning (SAQA, 2002a).

As a result of the above Policy, the SGB for ECD (SAQA, 2002), subsequently amended the ECD Level 1 and L 4 Certificates to include the fundamental requirement. The National Certificate for ECD L4 thus consists of 120 credits, 36 credits comprise the fundamental category (16 credits for mathematical literacy), 64 credits make up the core and 20 credits make up the elective category, (see Appendix 1) for illustration of a qualification structure.

This is a new development for the ECD field as prior to the gazetting of the FETC Policy, the core and elective components were covered in the training offered by ECD training providers. This meant that as of 2002, ECD practitioners have to now complete a further 36 credits in terms of fundamental training in order to obtain the National Certificate in ECD- NQF L4.

The implication is that the majority of practitioners trained in the past by NGO's would still need to undertake fundamental training to obtain recognition at NQF L4. In this regard, Short & Pillay (2002), point out that the National ECD Audit conducted in 2001 mentions a figure of approximately 58 000 practitioners as being under qualified by the DoE.

Working for an RTO, I have observed that the inclusion of mathematical literacy at NQF L4, has presented new challenges for both training providers and practitioners. On the one hand, many training providers do not have the expertise to facilitate mathematical literacy and have tendered this training to consultants and ABET providers. On the other hand, I have observed that many practitioners have not studied mathematics in formal schooling between Grade 10 to 12. Hence, there was a general outcry from the field about the inclusion of mathematical literacy in the ECD qualification, as there was a feeling that this inclusion could pose a barrier to practitioners achieving a full qualification in ECD.

As a result of dissatisfaction from certain sub sectors (including the ECD sub sector), regarding the compulsory requirement to undertake mathematical literacy for a NQF L4 qualification, SAQA commissioned a quantitative research study on mathematical literacy. The recommendation from the majority of respondents to the study was that the rules of combination concerning the fundamental component of the qualification for levels 1-4 be revised such that there is no longer a requirement for the mathematical literacy credits to be at the same level as that of the qualification (Hallendorff, 2003a).

## **1.2 AIM AND CRITICAL QUESTIONS**

I have served on various national policy making structures for ECD and have participated in the intense discussions around the challenges the practitioners have, to meet the outcomes for mathematical literacy. This has motivated me to undertake a study on mathematical literacy in the ECD curriculum from the perspective of the practitioners.

The practitioners are in the majority black women, marginalized as ECD workers, receiving an allowance of less than R500 per month, 58 000 are seen as under-qualified, 23 % are noted as having no training. I believe that the effects of apartheid are still evident in the lack of recognition and undervaluation of the important work they are undertaking in nurturing and educating young children. In this regard, I believe that their views on mathematical literacy would be crucial as they are the 'users'. The study explored how ECD practitioners negotiated the mathematical literacy curriculum and the meanings they made of their experience at a personal and professional level.

Given that mathematical literacy is beginning to be implemented by training providers and the fact that there is limited documentation on this issue in ECD to make solid judgements as to whether mathematical literacy at NQF L4 is indeed a challenge for practitioners. It was envisaged that the findings in this study could inform policy, practice and future research.

**The key critical questions explored in this study were:-**

1. What are the practitioner's and trainers views on the value of mathematical literacy in the practitioner's professional and personal lives?
2. What is their experience of the mathematical literacy curriculum including the delivery of the training with respect to teaching strategies, content and assessment procedures from the perspective of the practitioner and trainer in the context of policy requirements?
3. What are the views of trainers and practitioners with respect to what mathematical literacy is necessary for ECD practitioners?

## **CHAPTER TWO: REVIEW OF LITERATURE**

### **2.1 INTRODUCTION**

This chapter has three aims: firstly, to discuss key concepts and policies of relevance to the study within South Africa. In this regard the further Education and Training Certificate, National Certificate in ECD and the mathematical literacy unit standards will be examined in detail. The second aim is to present the theoretical framework that informed this study, and the final aim is to review current available literature in South Africa and internationally that engages with the debate on mathematical literacy.

### **2.2 THE NEW DEMOCRACY IN SOUTH AFRICA AND ITS IMPACT ON EDUCATION POLICIES...**

#### **2.2.1 Introduction**

The South African Qualifications Authority Act (SAQA), 1995 (Act No. 58 of 1995) was the first law passed by the democratic Parliament aimed at designing a national learning system. The Act embodied the Government's integrated approach to education and training (Department of Education (DoE), Department of Labour (DoL), 2003).

Keeping with the global trends of qualification frameworks and the need to promote equity in education in South Africa, SAQA was established as a statutory body responsible for overseeing the development and implementation of the National Qualifications Framework.

**The objectives of the NQF are to:**

- create an integrated national framework for learning achievements;
- facilitate access to and mobility and progression within education, training and career paths;
- enhance the quality of education and training;
- accelerate the redress of past unfair discrimination in education, training and employment opportunities and thereby;
- contribute to the full personal development of each learner, and the social and economic development of the nation at large (DoE, DoL, 2003: 3).



'By establishing a National Qualifications Framework which integrates all elements of the education and training system, we must enable learners to progress to higher levels from any starting point. They must be able to obtain recognition and credits for qualifications and towards qualifications from one part of the system to another. The system must enable assessment and recognition of prior learning and skills acquired through experience, an issue crucial to this study. Curricula should therefore cut across traditional division of skill and knowledge" (Doe, DoL, 2003:5).

### **2.2.2. Architecture relating to standards setting**

The current NQF framework comprises eight levels, of which levels 1 and 8 are open-ended. The levels are grouped in three bands. Level 1 (and below) comprises the General Education and Training band, Levels 2-4 comprise the Further Education and Training band, and levels 5-8 the Higher Education and Training band.

The NQF is divided into 12 organizing fields, and a National Standards Body (NSB) has been established for each field. ECD as a subfield falls into the education and training field under the auspices of the NSB (05). Mathematics falls within the field NSB (12) (DoE, DoL, 2002).

National Standards Bodies principal task is to ensure that suitable standards and qualifications of high quality are generated from their learning fields and recommended to SAQA for registration (DoE, DoL, 2002).

Standards Generating Bodies (SGB's) develops unit standards and qualifications and submits them to the NSB for approval (DoE, DoL, 2002).

Education and Training Quality Assurance Bodies (ETQA's) quality assures education and training provision across the range of standards and qualifications for which they are accredited. In the case of ECD, the quality assurance body is the Education, Training and Development Quality Assurance (DoE, DoL, 2002).

A qualification is defined by SAQA as a 'planned combination of learning outcomes which has a defined purpose, and which is intended to provide qualifying learners with applied competence and a basis for further learning'. It thus refers to the formal recognition of the achievement of the required number of credits and such other requirements at specific levels of the NQF as may be determined for example by the respective SGB, registered by SAQA. A Qualification can be made up of unit standards or whole qualifications.

Any qualification comprises fundamental, core and elective components taking into account the respective needs of a particular constituency (SAQA, National Qualifications Framework and Curriculum Development, 2000).

### **2.2.3 What is the Further Education Training Certificate (FETC)?**

The FETC cuts across all NSBs and SGBs and attempts to fulfill a variety of needs within the education and training sector at these levels. Provision includes learners in formal schooling, technical colleges, ABET, ECD and workplace based training centres. SAQA is responsible for the development of the minimum requirement and guiding principles for FETC qualifications.

**The primary purpose of the Further Education and Training Certificate is to:**

- equip learners with the knowledge, skills and values that will enable meaningful participation in and offer benefits for society.
- provide a basis for continuing learning in higher education in training.
- enable learners to be productive and responsible in the workplace (SAQA, 2001a).

The latter statement emphasizes the fact that the NQF is a social construct, intended to serve the social needs of the South African society, the economic needs of the society, and the needs of each individual in line with the values espoused by the South African constitution.

The qualification is not meant to focus only on the academic side but has to be related to a context captured in the Policy as 'any qualification registered on the NQF is intended to provide qualifying learners with applied competence and a basis for further learning' (ibid: 8). The intention is that all FETC qualifications must enable progression along a valid career path and they should enjoy equal social value.

### **2.2.4 SAQA policy concerning National Certificates at NQF levels 1-4**

SAQA registers a qualification as a National Certificate at levels 1 to 4 where it has:

- 120 (one hundred and twenty) or more credits in total, with
- 72 (seventy-two) credits at or above the level at which the certificate is registered.
- Of these 72 credits, there shall be at least 36 credits in the Fundamental Category as follows:

- at least 20 (twenty) credits shall be from the field of Communication Studies and Language, and
  - at least **16 (sixteen) credits shall be from the sub-field of Mathematics.**
- a minimum of 36 (thirty-six) credits at level 1 and 52 (fifty-two) at levels 2 to 4 shall be divided between the Core and Elective categories, with each qualification specifying the distribution of credits required in these two categories, provided that the range of additional credits shall be broad enough to enable learners to pursue some of their own learning interests (SAQAa, 2001: 21).

### 2.2.5 Unpacking Mathematical Literacy as fundamental learning

The fundamental category in a qualification refers to those outcomes that are critical to a learner's learning requirements. This category forms the basis for learning and promotes lifelong learning. It may not link to the general or specific purpose of the qualification. The most important consideration in including the compulsory credits in fundamental learning is to ensure coherence and equal acceptance of the FETC qualification regardless of its focus (SAQA, 2001a).

SAQA has indicated that the 16 compulsory credits in mathematics must be obtained at NQF level 4 and articulates further that:

- the learning outcomes and associated assessment criteria must be of the level required by a learner to participate effectively in society.
- it should be possible to achieve outcomes in a variety of learning and notes that the learners will have achieved the same Mathematics outcomes but these may be obtained in different contexts so that the emphasis is not on the study of concept in the abstract or more specifically in Mathematics as a subject, thus the issue of contextualization is made quite clear for curriculum writers.
- the learning outcomes and associated assessment criteria will clearly have to take into account the particular needs of all stakeholders in the FETC.
- the intention is that the Mathematics credits must **support the purpose of the qualification** and
- the compulsory credits should contribute positively to learning and **not pose an unnecessary barrier to further learning** (SAQA, 2001a).

The above statements become crucial for curriculum developers when they design learning programmes for mathematical literacy for the different sub fields.

### **2.2.6 Justification of Mathematical Literacy as fundamental learning**

South Africa has come from a past in which the poor quality or lack of education resulted in very low levels of literacy and numeracy in the adult population. In situations in which education was of an acceptable standard, mathematics was not taken beyond Grade 9 by about 40 % of the school going population. To some extent, Adler (cited in Bopape, 1998) argues that mathematics served as a gatekeeper in terms of streamlining people into different career paths based on colour and class. Mathematics taught had very little relevance to people's economic, social and political activities. Rote learning constituted one of the main teaching approaches. This approach nurtured the view that mathematics was an unalterable body of truths, that all learners had to do was to memorize formulae and theorems, and reproduce them in tests and examinations. No value was placed on critical thinking and problem solving, relating it to people's environment.

As a result of the ravages of the apartheid education system, SAQA highlights the point that the primary reasons for including the requirement for 16 credits from the mathematics field for a FETC qualification is an attempt to bring some coherence to the qualification and promote equal acceptance at all levels of society. This is needed by all citizens to function effectively in and contribute to society. Currently, there are a number of qualifications at the Senior Certificate level each of which enjoys different levels of social acceptance.

The diversity of construction of qualifications from a Senior Certificate with matriculation endorsement to a National Training Certificates encourages these different perceptions about the validity of the achievement, and hence, intellectual ability of its holder, i.e. the societal grading of the qualifications (SAQA, 2001a). The FETC policy points out that the contextualization of the fundamental learning is also critical to ensure that it remains meaningful for learners within their contexts of learning.

The question then arises as to the degree of coherence that should be prescribed or the amount of learning that must be common for all learners in the FETC band to ensure that progress to further learning is possible within the variety of contexts, an issue that is contested by different stakeholders within the formal and non formal sector. The structure and rules of combination for this qualification discussed above then become crucial in ensuring that barriers to access higher education and training are not created.

### 2.2.7 Implications for Practice

The policy means that for Certificates at levels 1- 4, there must be 16 credits from the sub-field of mathematics (in the fundamental category) *at the level of the qualification* e.g. a certificate at NQF 4 will require 16 credits from the mathematics sub-field at level 4; a certificate at NQF 3 will require 16 credits from the mathematics sub-field at level 3. For an ECD provider, it means auditing the skills and knowledge level of trainers in mathematical literacy, deciding whether training of staff or employment of specialist personnel is the best option. The design of the appropriate curriculum and appropriate assessment strategies is another issue to factor in. The credit value of mathematical literacy is based on the assumption that people starting to learn towards this unit standard are competent at L3 in mathematics (SAQA, 2001c). The latter therefore implies the need for providers to take into account the learning assumed to be in place and embedded knowledge required of learners before enrollment onto the NQF level 4 certificate.

Whilst there is valid reasons to have learning assumed to be in place, the reality is that the assumption is invalid for the vast majority of the population in South Africa and thus may compromise the successful implementation and completion of the programme (Association of Mathematics in South Africa (AMESA), 2003). The question then arises as to whom to accept for ECD training at L4, someone with an NQF L3 background in mathematics, or someone lower in the NQF ladder. The latter thus implies developing a bridging programme or offering skills programmes to enable the learner to obtain a full qualification.

Whilst the latter may impact on time frameworks and costing, the offering of skills programmes or bridging programmes is crucial in view of furthering the career opportunities of this marginalized grouping of ECD workers. Many RTO's have chosen to tender out the mathematical literacy training as a result of the lack of subject matter expertise in their staffing.

## **2.3. CONTEXTUALIZING MATHEMATICAL LITERACY**

### **2.3.1 Defining the concept**

Erik Hallendorff (2003:68) suggests the following as a working definition of mathematical literacy: ' mathematical literacy provides learners with the opportunity to use acquired mathematical skills to model, handle and solve real-life problems in different contexts, while consolidating and extending such knowledge. This includes the ability to interpret and make sense of numerical and spatial information communicated in tables, graphs, diagrams and texts'.

AMESA (2003) contends further "If literacy is the ability to read and write, then mathematical literacy should be the ability to read, write, and engage with information and situations that are numerical in nature and mathematical in structure. Mathematical literacy is reflected in habits and behaviors and ways of engaging with problems and situations. Mathematical literacy is further reflected in the confidence with which a person uses the mathematical algorithms or knowledge' (Hallendorff, 2003a).

Mathematics Literacy is an individual's capacity to identify and understand the role that mathematics plays in the world, to make well-founded mathematical judgments and to engage in mathematics in ways that meet the needs of that individual's current and future life as a constructive, concerned and reflective citizen (Program for International Student Assessment, cited in Hallendorff, 2003a).

Tout & Schmitt (2000) put forward an interesting scenario with the following statement, whether it is to interpret information in a political television ad, make a deal when buying a car, read a map, and follow the instructions in a diagram at work...most people today need mathematical skills to negotiate the demands of life. Is this numeracy or mathematics?

The terminology that appears to be used interchangeably with mathematical literacy internationally is adult numeracy. The emphasis on numeracy is also on problem solving with a view that adults can engage in personal and work related activities.

Being numerate, suggests Gal (1994), involves possession of some literacy skills and some mathematical skills and being able to use them in combination, as required by the situation at hand.

Tanner, Jones & Davies (2002) define numeracy as a proficiency, which is developed mainly in mathematics but also in other subjects. It is more than an ability to do basic arithmetic? It involves developing confidence and competence with numbers and measures...numeracy also demands understanding of the way in which data are gathered by counting and measuring, and presented in graphs, diagrams, charts and tables. The authors suggest that numeracy is about using mathematics, both theoretically and practically in different contexts.

What comes through in the definitions is that numeracy as it is referred to in the United States and other countries is much more than addition, subtraction, division and multiplication. According to Tout *et al* (2000), it includes the ability to manage and solve problems using measurements, space, data and numbers in a variety of formats and for a variety of purposes. It is as important for an engineer as it is to a student, a parent.....the different contexts will require different mathematical literacy to engage in. The authors make the point that numeracy has often been cast as a pretender, the inferior partner to mathematics. The aims of numeracy are similar to that of mathematical literacy i.e. it is about solving problems, making interpretations, it is necessary for all citizens irrespective of the type of job involved.

What emerges in unpacking the mathematical literacy and numeracy definitions is their use in real life situations, and that it can be used in a goal directed way, depending on the needs of the person and context e.g. home, workplace. The second point that emerges from the definitions is the relationship between numeracy and literacy. To understand certain graphs, instructions etc, one needs literacy skills. The third point that emerges is the social justice contention, that mathematical literacy is a basic human right that should be available to every citizen in any democracy. In South Africa, this right is enshrined in the constitution. At an implementation level, the FET Certificate has made mathematical literacy compulsory thereby contributing to developing critical thinkers as citizens, workers and learners, irrespective of race, gender and class.

### **2.3.2. Aims of the Mathematical Unit Standards in the context of South Africa**

Orton & Wain (1994) argue the point that aims should be a precursor to detailed specification of a curriculum. The aims of mathematics generally link to the educational aims of a country. Governments see the purposes of education as concerned with broad issues such as nation building or the provision of an educated population, which will enable a country and its economy to develop and thrive, hence a national curriculum. In South Africa, Outcomes- Based Education (OBE) is the new system of education.

The focus of transformational OBE and training is the link between the intentions and results of learning rather than the traditional listing of content to be covered within a learning programme (DoE, 1997).

The mathematical literacy standards that are compulsory for the National Certificate at NQF L4 are the following:

- Use mathematics to investigate and monitor the financial aspects of personal, business and national issues
- Apply knowledge of statistics and probability to critically interrogate and effectively communicate findings on life related problems
- Represent, analyze and calculate shape and motion in 2 and 3 dimensional space in different contexts (SAQA, 2001c).

These generic unit standards have been developed by the FET Mathematics SGB, with the expectation that users will contextualise them accordingly. Each unit standard has its own set of assessment criteria and range statements (see Appendix 3 for a sample of a mathematical literacy unit standard).

The unit standards underlines the point that the credit value for each standard is based on the assumption that people starting to learn toward this unit standard are competent in mathematical literacy at NQF L3 . The unit standards also point to embedded knowledge that a learner is expected to have such as techniques for representing and evaluating statistics, properties of geometric shapes, compound increase and decrease, taxation. The unit standard states further that candidates are unlikely to achieve all the specific outcomes in the standard without knowledge of the embedded knowledge listed in each of the three unit standards (SAQA, 2001c). The latter has serious implications for learners undertaking vocational qualifications and who may not have had the opportunity to study mathematics at school at whatever level. In this regard, union representatives in making a submission on the NQF Study noted that many workers could be held back in their skills development and career path by an over specification of fundamental learning (DoE, DoL, 2002). The latter could also imply that the contexts of the various learners need to be acknowledged in the development of mathematical literacy standards.



A mathematical literacy that relates to the society that the adolescent and adult participate in is essential for personal empowerment and to help make sense of that society. Without an appropriate level of mathematical literacy, a person cannot participate fully in democracy. The workplace requires elements of mathematical literacy irrespective of the specialized mathematics that could in addition be required for particular purposes e.g. reading a timetable, measurement of a room .

The mathematical literacy unit standards are not intended to be a base for the mathematical knowledge and skills required for Higher Education but are required for life. The FET SGB task team (2003), contend that the mathematics required to be mathematically literate is put into place by the General Education and Training Band. Learners leaving the GET band should normally be about 15 years of age. As they mature through adolescence and into adulthood, aspects of living, career and responsible citizenship, take on a more real and immediate perspective. Increased personal and social maturity requires that more complex situations be faced and that a critical acumen be developed accordingly (Hallendorff, 2003a).

In the SAQA commissioned research on the mathematical literacy compulsory requirement for a qualification, 86% of the respondents recommended that the rules of combination be changed to allow choices in terms of the level of mathematical literacy required for a particular qualification. The latter is captured in the research report as 'there should be no uniform requirement for mathematics/mathematical literacy, and SGB's should determine the said requirements within the context of each qualification' (Hallendorff, 2003a: 45). What appears to emerge from the research is that there was no total opposition to the concept of mathematical literacy being included in a qualification. This is in line with the SAQA principle that components within a qualification must be fit for purpose and should not serve as a barrier to further training (SAQA, 2001, DoE& DoL, 2002, Hallendorff, 2003a).

## **2.4 MAKING A CASE FOR MATHEMATICAL LITERACY: A SOCIAL JUSTICE IMPERATIVE**

Being mathematically literate enables persons to contribute to and participate with confidence in society. Access to mathematics is, therefore, a human right in itself. From a personal perspective, Gal (1994) adds that one basic goal of adult numeracy education is to develop student's positive attitudes in their own mathematical power and positive beliefs about the contribution of mathematical reasoning to their real world functioning.

Frankstein (1998) supports the latter view that mathematical literacy is essential as many people have internalized negative self-images about their knowledge and ability in mathematics. It is my contention that such negative views are also transferred to mathematical literacy and it is therefore crucial that the same goal mentioned in adult numeracy is applied for mathematical literacy.

The FET SGB strongly argues that mathematical literacy should be driven by life-related applications of mathematical habits of mind and put forward three different scenarios described below (Hallendorff, 2003a).

In everyday life a person is continually faced with mathematical demands, which the adolescent and adult should be in a position to handle with confidence. These demands frequently relate to financial issues such as hire purchase, mortgage bonds, and investments. There are however others such as the ability to read a map, follow timetables, estimate and calculate areas and volumes, understand house plans, and sewing patterns. Situations such as in cooking and in the use of medicine requiring the efficient use of ratio and proportion are encountered on a daily basis. Here mathematical literacy is required to be a self-managing person.

The workplace requires the use of fundamental numerical and spatial skills in order to efficiently meet the demands of the job. To benefit from specialized training for the workplace, a flexible understanding of mathematical principles is often necessary. This literacy must enable the person to, for example, deal with work-related formulas, read statistical charts, deal with schedules and understand instructions involving numerical components. In modern technologically driven environments the mathematics required to use computer tools such as spreadsheets is often an asset. Such literacy will enable the person to be a contributing worker.

To be a participating citizen in a developing democracy it is essential that the adolescent and adult have acquired a critical stance to mathematical arguments presented in the media and other platforms. The concerned citizen needs to be aware that statistics can often be used to support opposing arguments, say for or against the use of an ecologically sensitive stretch of land for mining purposes. In the information age, the power of numbers and mathematical ways of thinking often shape policy. Unless the citizen appreciates this, the citizen will not be in a position to use the vote appropriately.

Orton and Wain (1994) support the view of '*that mathematics*' that is applicable and is required in daily life and at work. For example in daily life, to get by in industrialized society one will need such skills as the ability to recognize numbers in a variety of contexts, use a calculator with understanding, to tell the time, read a timetable, to understand and be able to work with the normal measures of weight, length, area and capacity. These skills enable a person to carry out the basic tasks of living including being aware of time, to cook, to make sense of instructions to use a range of gadgets such as cookers.

The National Council for teachers of mathematics in Australia (cited in Atweh & Heirsdorf, (2005:1) also supports the equity and social justice framework by contending that 'the social injustices of the past can no longer be tolerated...mathematics has become a critical factor for employment and full participation in our society. We cannot afford to have the majority of our population mathematically illiterate. Equity has become an economic necessity'.

Slammert (cited in Bopape, 1998), argues for 'maths for liberation' as the educational system in South Africa has been pervaded with imperialist ideology. The author contends that maths for liberation, will see in students the ability to integrate knowledge from different mathematical topics, it will be seen as a human construct, not confined to a particular species based on race and ultimately contribute to demystifying mathematics. The author makes the point that 'maths for liberation' can contribute to breaking the ideology that maths is for certain races or class structures thereby ridding its role as a gatekeeper in terms of career pathing for the majority of the population in South Africa.

In South Africa, ECD, which is female, dominated, has been and is still devalued and marginalized. It has been well documented that professions where women are over-represented are also those that are devalued with respect to status and salary. This appears to hold true for the context of ECD given the low salaries as compared to other professions (DoE, 2001).

An improvement in the status of ECD practitioners through appropriate salary structures and social recognition is possible through the completion of the FET Certificate or for that matter the outstanding mathematical literacy learning components required as of 2002. Women practitioners will have more choices in terms of career paths, thereby contributing to breaking the cycle of poverty.

Most importantly, they will, through understanding the purpose of mathematical literacy themselves see the value in inculcating a love for mathematics by children that they teach, not only as part of preparation for formal schooling but also as part of broader social development paving the way for equity for the majority of children as future citizens of South Africa. The latter can certainly contribute to the process of demystifying mathematical literacy as argued by Slammert (ibid).

## **2.5 MATHEMATICS AND THE WORLD OF WORK**

The link between school mathematics and the needs of employment is often very questioned by employers. For many employers the mathematic techniques they use is not taught at schools. This has been well documented by Fitzgerald (cited in Orton *et al*, 1994) who make the point that many workers found it hard to recognize that they were using mathematics at all for example in measuring, reading a map.

On studying school leavers in their first jobs, Fitzgerald (ibid) noted that the mathematics used was rarely dependent on what had been learnt at school. The employees had devised their own idiosyncratic methods for problem solving in spite of being taught specific formulae at school. Workers or supervisors devised the methods as the process was clear to them and accepted as part of the trade. Fitzgerald therefore questions the value of some of the more advanced mathematical training done in a theoretical way, and when the reality of the workplace has no place for such theoretical explanation without a practical application.

Ivor Blumenthal, CEO of the Services SETA in South Africa, supports the above statement and states that the Learnership Programme is hampered by the poor educational level of the matriculants and graduates in South Africa. He articulates the following ' the average graduate with a three year degree has less than the equivalent of Grade 9 level of literacy and numeracy competence... we're seeing graduates in the learnerships who are proving to be functionally innumerate. The point that can be inferred from his statement is that mathematics in school and tertiary institutions do not prepare the learners for the world of work, and hence to cope within the Learnerships. Employers and coaches instead of being life skills coaches become literacy and numeracy coaches, and thus the aims of the learnership can become blurred and take the programme more time to complete (Business Times, 2005:16).

The latter view is supported by Hallendorff (2003b) who contend that the cry from employers in South Africa is that 'people cannot solve problems- their maths is of no use to me'. He points to the gap between the expectations of employers and the abilities of the employees in terms of numeracy. Many students and teachers believe that the main reason for studying the subject is to pass tests and this will lead them to successful tertiary studies and employment. Hallendorff (ibid) suggests that the basic need for people with regards to mathematics is solving problems. People should be able to devise and implement strategies to solve real life problems involving physical quantities e.g. distance, money..., making use of the tools of mathematics e.g. addition, multiplication, and equipped with a good understanding of concepts such as ratio and proportion, averages and percentages, be functionally numerate.

Learning of mathematical literacy is therefore, perceived as a combination of being able to do something, having a basic understanding of what you can do, and locating this in the broader sphere of the society or workplace. The latter statement highlights the significance of applicability of mathematics, which is referred to as mathematical literacy in this study.

In terms of ECD, the Revised National Curriculum Guidelines define the goals for mathematical literacy from the perspective of the children. There is not sufficient documentation as to whether the mathematical literacy which forms part of the practitioners training is impacting on the teaching methodologies and confidence levels of the practitioners given that this is a new area. This study attempts to investigate the value of mathematical literacy in the context of ECD, this is however a very small study, hence there is a need to follow up this area in terms of future research.

## **2.6 THE SIGNIFICANCE OF THE CONSTRUCTIVIST APPROACH IN TEACHING MATHEMATICAL LITERACY**

Given the rote approach to teaching mathematics and the latter serving as a gatekeeper in South Africa, the approach to teaching mathematical literacy in this context deserves attention. Hallendorff (2003b) argues that the constructivist approach views learners as having prior knowledge and life experiences, and learners should not be seen as empty vessels that must be filled. The learner adds new knowledge to the existing knowledge by making sense of it in terms of what is already inside his or her head. The learning happens as students engage in a series of carefully designed tasks, which are solved in a social environment.

Students make discoveries for themselves, share experiences with others, engage in helpful debates about methods and solutions, invent new methods, articulate their thoughts, borrow ideas from their peers and solve problems.

Hallendorff (2003b) further argues that the basic premise, which calls for this approach, is that conceptual knowledge cannot be transferred ready-made from one person to another. Conceptual knowledge must be constructed and internalized by the learner. This approach places the responsibility for learning in the hands of the student and promotes self-confidence, self-reliance; ability to develop problem-solving strategies, and exercises logical thinking and thus the lesson becomes enjoyable. Constructivism, according to Orton *et al* (1994) is being interpreted as advocating discovery and inquiry based learning, incorporating opportunities for discussion and the negotiation and exchange of ideas. Thus the use of the interpretive paradigm adds value to this study as it is about interpreting experiences by people in different contexts.

This approach also calls for the learner's context to be taken into account. The learner could be a child or an adult. Evidence from the South African study on mathematical literacy seems to suggest that learners in the different sub fields of education are able to grasp mathematical concepts more easily when approaching the learning through realistic contexts, including problem-solving i.e. applying it in their work context (Hallendorff, 2003a). Interestingly, the significance of culture, which forms part of the social environment, does not feature strongly in the teaching of mathematical literacy. Bishop (cited in Orton *et al*, 1994), contends that all societies exhibit mathematical activity in some form. He classifies this under six categories i.e. counting, locating, measurement, designing, paying and explaining. Bishop suggests the use of the six categories as a way of bringing about mathematical enculturation. The intention according to Bishop is to 'unlock the mathematics frozen in different cultures'.

If one accepts the constructivist approach that teaching should take note of the learners social and physical environment, mathematical literacy should draw on these experiences i.e. mathematical heritage from different cultures e.g. the rangoli patterns used in Hindu families, the geometric art which forms the basis of the Islamic designs in mosques, the calendar which determine the Jewish and Chinese new year, the spatial design of African art found in huts, paintings etc. This can add value to lessons and also contribute to the level of confidence of students being enhanced and bringing 'life into the class'. The notion of the integration of culture into various curricula is also enshrined in SAQA's policies regarding standards and qualifications (SAQA, 2002). Williams *et al* (1993) argue that the mathematical curriculum must provide opportunities for all learners to recognize that all cultures engage in mathematical activity and that no single culture has a monopoly on mathematical achievement.

Orton *et al* (1994) argues the point that the challenges that constructivism poses for teaching mathematical literacy should be examined as well. The following highlights some of these challenges. The concern that the prescribed curriculum may not be completed by the end of the year is an obstacle that teachers or trainers face and thus may compromise their approach to teaching. The second possible problem that the trainers experience according to Orton (1994), is that anything other than transmission teaching is inclined to make us feel we are not really teaching, this view is also generally held by the general public and is not helped at home when children remark that their teacher never teaches them anything. The latter view also affects new teachers, who coming out of a past of 'transmission teaching' may believe that this is the best way of teaching.

Personal beliefs about teaching mathematics can therefore exert a powerful influence on classroom practice. This is aptly expressed by Manouchehri (1997, cited in Hobden, 1999) who notes that research on personal beliefs consistently shows that teachers transcend their knowledge of mathematics and pedagogy into practice through their filter of their beliefs. In effect the latter alludes to the fact that if trainers who learnt mathematics through the transmission or drill teaching method are likely to use the same methodologies in their own teaching practices of mathematical literacy. In ECD this can affect the methodology of teaching of mathematics to young children, which can have negative consequences e.g. teaching without understanding.

Students also may value teachers who 'can explain things clearly' and so it is reasonable to assume that this perception of the role of the teacher is carried through to when they themselves become teachers (Orton *et al*, 1994). The latter also has implications in certain contexts where children are taught that the teacher knows best and that they should listen to them without questioning them. Orton *et al* (1994) argue further that in such societies, teaching methods based on the constructivist model may take time to develop, but must not be considered impossible. The point made by Orton *et al* (1994) is that 'explanations by a teacher are a valuable tool, at the same time it must be balanced with the principle of student input.

In the constructivist approach the notion that the environment needs to be rich in opportunities for learning poses problems in working with impoverished communities. Hence, the provision of basic materials is vital to level the playing fields between impoverished and well-resourced communities. A further challenge in South Africa according to AMESA (2003) is that there are no appropriately trained mathematical literacy facilitators in South Africa, as it is a new area.

One can argue that teachers or facilitators training others in mathematical literacy can slip into the drill method of teaching and teaching without contextual understanding. This issue deserves further dialogue and research.

Thus, from the issues presented by Orton *et al* (1994), there is no doubt that the adoption of teaching strategies in the context of constructivism presents challenges, but effective teaching is hard work. Vygotsky, a proponent of the constructivist approach, argues the point that facilitators should structure learning situations in which learners can interact with new knowledge that is appropriate and which learners can use in different contexts. He refers to this as the 'zone of proximal proximity', which in his terms is the 'actual development level as determined by independent problem solving and the level of potential development as determined through problem solving in collaboration with more capable peers'. Providing the appropriate assistance, which he refers to scaffolding, will help the learner achieve the task. Once the task is mastered, the assumption is that the learner will be able to complete the task on his own. Skills and knowledge, he argues are thus best acquired in context (Goldfarb, 2001). The mathematical literacy unit standards does talk to contextualizing the standards, which appears to be one of the challenges facing curriculum designers in the different sub fields of education.

South Africa coming from a system of apartheid, which advocated rote learning, and in the words of Freire 'a banking system of education' certainly can do with a changed approach to teaching and learning strategy. The words of Wood (cited in Orton *et al* ,1994:56) provides an interesting approach to teaching practice in this regard: " the perspective I have adopted on the nature of knowledge and its relation to formal systems of thinking...precludes an approach to teaching that is based on universal and invariant 'steps' and 'stages'... rather, it invites interaction, negotiation and the shared construction of experiences...the only way to avoid the formation of entrenched misconceptions is through discussion and interaction. A trouble shared, in mathematical discourse, may become a problem solved'.



## 2.7 CONCLUSION

This chapter reveals the distinction between mathematics and mathematical literacy. Mathematics is in the main abstract, offering systems of results about relations among ideal objects, whereas mathematical literacy is far more concrete and contextual, driven by real life situations, and generally involving the application of basic mathematics in contexts of varying complexity (Hallendorff, 2003). Mathematical literacy is vital in the context of the personal, work and wider society. The latter has therefore been included as part of fundamental learning as a strategy of readdressing past inequalities and promoting equity by enhancing life long learning and opening the doors to further learning and training for the majority of people previously denied the right to education in South Africa. As mathematical literacy is new and has a particular purpose, the teaching of the subject and the context of the learners needs to be taken into account, hence the need for training in this area. In ECD the issue of equity is crucial as the majority of practitioners are marginalized black women; the profession is undervalued and has a low status. Achieving registered qualifications will enhance the career paths of practitioners breaking the cycle of poverty thereby empowering practitioners. The next chapter will address the methodology used in the study.

## **CHAPTER THREE: RESEARCH METHODOLOGY AND DESIGN**

### **3.1 INTRODUCTION**

Cohen, Manion & Morrisson (2000) makes the point that the purposes of research determine the methodology and design of the research. This chapter addresses the context of the study including a description of the participants. It describes the research design and research methodology used and points to some of the possible limitations of the study.

### **3.2 CONTEXT OF STUDY**

Short & Pillay (2002) argue that the training of ECD practitioners is critical and suggest that, 'one of the most important indicators of quality ECD programmes is the quality of training received by practitioners'. The authors point out that the National ECD Audit conducted by the DoE in 2001 showed that the 'vast majority of ECD practitioners are under-qualified (58%) or untrained (23%)'. This means that about 47 300 existing practitioners are in need of further training. The issue of training in line with registered ECD qualifications and affirming practitioners ECD experience through the recognition of prior learning are key aims of the training provider mentioned in this study.

The ECD training provider is situated in Durban now referred to as Ethekwini. The provider is a community based non-governmental organisation (NGO), focusing on ECD training and development, and is accredited by the EDTP SETA to offer NQF L1 to L4 ECD training. The provider leases premises from a further education and training (FET) college and is staffed by six full time staff members. The students or trainees are referred to as ECD practitioners, and are generally experienced practitioners seeking to upgrade their qualifications in line with SAQA registered qualifications. The majority of the provider's trainees are African women consistent with the findings of the National ECD Audit (Williams & Samuels, 2001).

### **3.2.1 Description of the ECD Learnership Programme**

From 2003 with the introduction of ECD Learnerships, the training provider has been contracted by the EDTP SETA to train approximately 40 learners toward the National Certificate in ECD within 14 months. The training was facilitated by the staff of the provider, except for mathematical literacy, which was tendered out to a FET lecturer as the staff did not have the subject matter expertise. The training for mathematical literacy took place weekly for approximately four hours. Contact training was approximately 80 notional hours. The practitioners hailed from KwaMashu and Ntuzama, townships situated on the outskirts of Durban. Originally there were forty practitioners enrolled, 38 were women and two were males. The consistent number on the attendance register reflected 37 practitioners.

A learnership by way of definition is a mode of delivering a learning programme that combines work-based experience with structured learning. It is one of the ways of obtaining a qualification. A person who completes a learnership will be able to 'demonstrate the practical application of competencies (skills, knowledge, values, and attitudes) in an employment context (ETDP SETA, 2002).

To participate in the learnership, one has to make an application to the EDTP SETA. One of the criteria is that one needs to be unemployed. The SETA is responsible for the selection of the candidates. The practitioners on the learnership serve as volunteers in local ECD Sites during their term of training. Their training is fully subsidized by the SETA, which includes an allowance for each practitioner.

### **3.2.2 Context of training**

The National Certificate in ECD is a NQF L4 qualification. The qualification of 120 credits is allocated to the three learning components as follows:

- Fundamental 36 credits at Level 4 (20 credits for communication and 16 credits for mathematical literacy)
- Core 64 credits at Level 4
- Elective 20 credits at or above Level 2

**The purpose of the qualification is to:**

- Enable learners to facilitate the all-round development of young children in a manner that is sensitive to individual needs (including special needs) and culture-fair within a specific phase of development and with specialisation in a particular setting or role.
- Provide further education and training opportunities for those with a NQF Level 1 qualification (or equivalent) as well as a basis for further professional development in the higher education and training band for many experienced practitioners in the field who have had limited or difficult access to further career development opportunities.
- Develop ECD educators with a sound practical qualification to provide quality early childhood development services for children in community-based services.

**This qualification provides an opportunity for:**

- existing learners/educators who have acquired a Level 1 ECD qualification to further their career path in ECD.
- potential learners/educators who have acquired a GETC qualification or its equivalent to embark on a career in ECD (entry point) (SAQA, 2002).

### **3.3. PARTICIPANTS IN THE STUDY**

The participants in the study were practitioners from the ETDP SETA learnership that was contracted to the ECD training provider described above. I used purposive sampling to select the 12 practitioners. The reason for the choice of sampling method was made on the basis of the nature of this study that of getting varied experiences. The latter is substantiated by Cohen *et al* (2001) who argue that 'in purposive sampling, researchers handpick the cases to be included on the basis of their judgment of their typicality.....building up a sample that is satisfactory to their specific needs '. Cohen *et al* (2001) add further that 'while it may satisfy the researcher's needs...it does not pretend to represent the wider population. It is deliberately and unashamedly selected and biased'. The aim of the study was conveyed to the trainer from the Project, who selected the names from the attendance register. I felt that in selecting practitioners, it should be more than what was recorded as their final marks and should include their participation in the training, hence the choice was left to the trainer.

Four practitioners were selected from a group that the trainers identified as struggling, 4 practitioners that were average and 4 that excelled in terms of marks and participation in class. As I never observed their participation I would not have been able to select as per the criteria described. The participants finally selected were 11 females and one male. All the selected practitioners agreed to participate in the study and gave me their permission to access and use their training materials as part of the study. It was agreed that their names will not be used in the study; reference will be made to practitioners using numbers to substantiate issues raised. The following reflects the profile of the participants:

<b>Practitioner</b>	<b>Gender</b>	<b>Highest level of mathematical literacy</b>	<b>Summative knowledge test %</b>	<b>Competency status (end of programme)</b>
1	F	Grade 11	98 %	C
2	M	Grade 10	58 %	C
3	F	Grade 8	70 %	C
4	F	Grade 11	92 %	C
5	F	Grade 9	86 %	C
6	F	Grade 11	79 %	C
7	F	Grade 9	37 %	NYC
8	F	Grade 10	62 %	C
9	F	Grade 12	66 %	C
10	F	Grade 10	66 %	C
11	F	Grade 9	40 %	NYC
12	F	Grade 9	did not write	NYC

### 3.4 RESEARCH APPROACH

I adopted a qualitative research design for this study. Bogdan and Biklen (1998), contend that qualitative research is naturalistic since it has actual settings, and the researcher is the key instrument. The qualitative researcher is concerned with the context because action is best understood when observed in the setting in which it occurs. Qualitative data is descriptive and takes the form of words and pictures rather than numbers. Since there is an element of the unknown in social research, a particular advantage of qualitative research is flexibility.

Bogdan & Biklen (1998) argue further that qualitative researchers are concerned with the process, rather than simply with outcomes. In this study, I examined the experiences of ECD practitioners of mathematical literacy within the context of the National Certificate for ECD. Qualitative researchers tend to analyze their data inductively since they do not search out data to prove or disprove the hypothesis they hold prior to entering the field. Researchers work directly with experience and understanding to build their theory on them.

Thus theory becomes sets of meaning which yield insight and understanding of people's behaviour (Cohen *et al* 2000). As a result, theory develops from the bottom up as the data is interconnected.

During the research, the researcher discovers what the important questions are since he or she does not know enough to be able to recognize important concerns prior to conducting the research (Bogdan *et al*, 1998). Neuman (1997) notes that qualitative data are empirical. They involve documenting of real events, recording what people say (with words, gestures and tones), observing specific behaviors, studying written documents, or examining visual images.

The study is a qualitative case study. Contexts are dynamic, and a case study approach allows one to investigate complex human interaction processes at work within a bounded reality. An advantage of a case study is that it allows one to portray participants lived experiences of thoughts about and feelings for a situation (Cohen *et al*, 2000).

### **3.5 THEORETICAL FRAMEWORK**

This study is located within an interpretivist paradigm as the research aim is to try to understand a particular situation or phenomenon. Symbolic interactionism and socio constructivism framed this study as a broad theoretical framework. The notion of symbolic interactionism derives from the work of G.H. Mead (1934) and subsequently associated with noted researchers such as Blumer and Becker. Blumer (1969) and Denzin (1992) argue that symbolic interactions rest on three root assumptions:

- human beings act towards things on the basis of the meanings that these things have for them. Symbolic interactionism holds the principle of meaning as central to human behaviour.
- the meaning of such things is derived from, and arises out of the social interaction that one has with one's fellows. The self is constructed through communication, and hence the significance of language.
- these meanings are handled in, and modified through an interpretive process used by the person in dealing with the things he encounters. Thought modifies each individual's interpretation of symbols.

This attribution of meanings, this interpreting, is what makes them distinctly human and social. Interactionists therefore focus on the world of subjective meanings and the symbols by which they are produced and represented. This implies not making any prior assumptions about what is going on... and giving priority to, inmate's own accounts.

This attribution of meaning to objects through symbols is a continuous process...the individual constructs, modifies, pieces together, weighs up the pros and cons and bargains. In terms of the social interaction, individuals align their actions to those of others. They do this by 'taking on the role of the other', by making indications to 'themselves' about the likely responses of 'others' (Cohen, Manion & Morris, 2000:26).

Interactionist theorists see humans as active, creative participants who construct their own world, not as passive, conforming objects of socialization. In the context of the study, the focus was on how ECD practitioners negotiate the mathematical literacy curriculum and the meanings they make of their experiences.

Socio constructivism is premised on a conception of knowledge as that which is constructed and not reproduced. This conception of learning is premised on the assumption that individuals actively construct their knowledge by fitting existing perceptions, interpretations and understandings with the knowledge obtained through collaborating, sharing, negotiating interpretations, experience and understanding with others. Meaning making is thus through exchange of ideas shared between facilitator and practitioners, between practitioners, reading and acting on grounded experiences. Therefore, when designing learning for practitioners, the context for practice is key, activities are grounded or situated in the very practice in which learning will be applied. Recognition of context requires the recognition of the culture of the community to which practitioners belong. Constructivist approach to facilitation requires the use of out comes based training rather than the conventional model of transmission teaching. This issue is also explored in depth in the literature study (Murphy, 2005).

### **3.5.1 Ethical Issues**

Cohen *et al* (2000) strongly advocate for social researchers to take into account the effects of the research on the participants, and to act in a way to preserve their dignity as human beings. A crucial factor for ethical conduct of research is gaining the informed consent of participants (Bogdan *et al*, 1998). In this study, I firstly sought the permission of the Board of Management as the practitioners are enrolled at the training provider that I work at; secondly, permission was sought from the relevant practitioners and trainers respectively.

I explained the purpose of the study, and the entire research process. It was impressed upon participants that their involvement was voluntary. Confidentiality was assured.

### **3.5.2 Data Collection**

Primary data was collected using the focus group interviews and a semi-structured interview with the trainer and co-trainer. Focus group interviews rely on interaction within the group, based on topics supplied by the researcher, who typically takes the role of moderator or facilitator. Focus groups are contrived settings, bringing together a specifically chosen section of the population to discuss a particular topic (Delamont, 1996; Cohen *et al*, 2002). It is from the interaction of the group that the data emerge. Their contrived nature is both a strength and weakness in that they are unnatural settings, and at the same time, can yield insights that might not otherwise have been available through a straightforward interview. They are economical in terms of time, producing a large volume of data in a short period of time (Cohen *et al*, 2000). The focus group was selected as it allowed me to obtain data from practitioners in a short space of time, at the same time allowing me to get relevant information from different practitioners in a flexible manner. As a social worker by training I also felt comfortable with this method as I had some experience in facilitating group work.

An interview schedule (See Appendix 2) was developed to guide the focus group interview. Participants within the focus group also filled a basic biographical questionnaire. The purpose was to gain personal and relevant details of the participants pertaining to the study. Interviews were conducted in both English and Zulu – drawing on Zulu as support. Participants were given the option to respond in either english or isizulu or in both languages. The first group participated totally in English and the second group used isiZulu as an alternative medium whenever they found the need to do so.

A semi-structured interview was used to obtain data from the outsourced trainer and co trainer from the provider who assisted in training to gain experience. Although an interview schedule was prepared, this was used as a guide and to prompt for responses where necessary. Document analysis was a secondary tool for data gathering. I selected the documents that added value to the study which included learner portfolios, training evaluation forms, and the training manual. The latter afforded me the opportunity to validate comments made in the focus groups as well as identify the challenges that the practitioners faced in the context of the study e.g. the portfolio was useful in identifying the assessment tasks and how the practitioners fared in this area.



I co-facilitated the focus groups with a trainer from the training provider who was not involved in this particular programme as a Trainer and was conversant in English and Isizulu. I explained the purpose of the study to the practitioners. Key explanations were done in Isizulu as well. I used an activity (See Appendix 2), to obtain the practitioner's understanding of mathematics and mathematical literacy, and practitioners understanding of what they thought were important, very important and not important for personal and professional development. This also served to 'break the ice'. The two focus groups took place on two different days.

A semi-structured interview was conducted with the outsourced trainer and assistant trainer from the Project. This method was chosen as it is less formal, allowing the opportunity for open-ended questions. Although I went into the interview with prepared questions, this was not fixed and I had the opportunity to probe more deeply where I felt the need to do so within the context of the research questions of the study.

All interviews were audiotaped using a dictaphone and later carefully transcribed. For the second focus group, the co facilitator transcribed the Zulu responses directly from the audiotape and shared this with me. I recorded it verbatim.

### **3.6 DATA ANALYSIS**

Once I obtained the information from the different sources, I made sure that it was transcribed into a readable written form. Qualitative data is often inductive, researchers rarely know the specifics of data analysis when they begin the data analysis when they begin a project, conclude Neuman (1997). Neuman suggests three steps in coding as one of the ways of analyzing qualitative data i.e. open coding, axial coding and selective coding (1997). I began to sift through the information, identifying similar responses to different issues referred to as 'open coding' by Neuman, possible links were identified and noted on the margins of the written transcribed notes. Conceptualization according to Neuman is one way that a qualitative researcher organizes and makes sense of data (1997). I recorded the first round of data into broad themes using the critical questions as a framework.

This was followed by reviewing what was put into themes, reconceptualising the themes from the data from the interview and documentary analysis put forward through the open coding, which Neuman (1997) refers to as 'axial coding'.

The final task of deciding on the themes that will be used, linking it to theories which Neuman (1997) refers to as selective coding i.e. involving the scanning of data and previous codes for documentation completed my analysis of the major themes that I hoped to use in sharing the data collected. As there were no fixed hypothesis in this study, new concepts could be formulated, evaluated against the data collected. Sometimes data was discarded and new more relevant data gathered forming new concepts obtained from for example the focus group interview.

The technique of triangulation was also used to verify data gathered. In this regard I used the evaluation forms completed by the practitioners after their mathematical literacy training which indicated their views on what worked well and what did not work well in the training programme as well as their recommendations. The other data analysis of documentation used was the portfolios of evidence which contained the practitioners' assessment activities. The latter two forms of data were used to cross-reference and clarify data. In this regard Neuman (1997) warns against researcher's preconceived ideas impacting on what data is accepted or rejected. In this study, the triangulation method was the safeguard used.

### **3.7 STRENGTHS AND LIMITATIONS OF THE STUDY**

As a staff member of the training provider involved in the study, I had access to the Project and resources, which included policy documents, written materials of relevance to the study and networks of people that I could contact when I found the need. I did have some apprehension about the possibility of the practitioners feeling obliged to participate and being inclined to provide responses that could be seen as 'positive' as I was part of the staff at the training provider in which they were undertaking their training. This was overcome by giving them a choice to participate and assuring them that participation and candid responses will not affect their status. The explanation in Isizulu and having the Isizulu speaking co-facilitator present, I believe, also helped in this regard. I did feel that not scheduling the focus group immediately after the training was a disadvantage, as practitioners tended to forget their experiences. In this regard, prior to the interview I asked these practitioners to read through their notes, evaluation forms and their Portfolios as a way of getting them to reflect on some of their training experiences in mathematical literacy. On reflection, observation of the training would have helped me to understand key issues more in depth.

The fact that the participants in the context of the learnership are not experienced ECD practitioners must be noted in the context of the issues raised in this study. It must be borne in mind that 58 000 Practitioners were regarded as under qualified in the National ECD Audit by the DoE, as they did not complete their fundamental training which included mathematical literacy and communication studies and language (Short *et al*, 2002). In the case of the learnership practitioners were unemployed people, the majority had between Grade 10-12 schooling, some had completed mathematics at some level in secondary schooling. The fact that some practitioners had undertaken mathematics in secondary school, whilst others had not therefore could have a bearing on the possible experiences of mathematical literacy between the two groups.

It must be pointed out that the data collected is by no means exhaustive, and is but a small sample that could be used to identify issues that could possibly be investigated in a more comprehensive and detailed study that could cover a longer time span with a larger sample.

### **3.8 CONCLUSION**

In this chapter, I have presented the different data collecting procedures that I have used for this research study which is located within a qualitative paradigm. The focus group interview was the main method of data collection, with documentary analysis supporting the data collected. To obtain maximum data, a semi-structured interview with the trainers was conducted. The triangulation of data helped to verify data which was then organized into themes based on the critical questions. I used Neuman's (1997) method of coding in the analysis process. The limitations of the research process were also noted. In the next chapter I will put forward some of the data obtained in terms of the critical questions and raise discussion accordingly.

## **CHAPTER 4: DATA ANALYSIS AND DISCUSSION OF FINDINGS**

### **4.1 INTRODUCTION**

In this chapter I draw on the theory of symbolic interactionism to address the meanings practitioners constructed of their mathematical literacy experiences. The theory of socio constructivism is also used as a tool to analyze the curriculum. I define curriculum very broadly to include the philosophy and values, content, learning and teaching methodologies, and assessment strategies.

I begin this chapter by addressing the practitioners and trainers views on the value of mathematical literacy at a personal and professional level. It will also include their understanding about mathematical literacy vs mathematics. Secondly, this chapter will examine practitioners experiences of the delivery of the mathematical literacy training which will include issues relating to context, teaching methodologies and assessment strategies. Finally, the chapter will address the relevance of mathematical literacy to ECD, which will include content from the perspective of practitioners and trainers. In analyzing the data, I was able to establish some recurring themes emerging and certain new concepts; these will be discussed using direct quotations from practitioners and trainers within a thematic framework.

### **4.2 VALUE OF MATHEMATICAL LITERACY TO ECD PRACTITIONERS**

#### **4.2.1 Introduction**

Pandor, Minister of Education in South Africa (2004), argues that mathematics has for a very long time been a preserve of a select few, and that many generations of South Africans have been denied access to mathematics because of apartheid and because of the myth that some are born either with or without an ability to study mathematics. It is upon this premise that mathematical literacy has been made compulsory at an FET level. It is a right that belongs to all citizens so that they can participate fully in democracy, in what society has to offer. It therefore embraces the principles of democracy, human rights, equity and social justice.

Pandor (2004) argues very strongly for the need for numeracy,' we neglect numeracy at our peril, real numeracy problems are not being able to understand the dial on your stove when you have a family to feed, or tell the time when you have a job interview...numeracy is essential in the choices our people need to make in a democracy. How can you understand inflation, national debt, national budgets without the ability to compute?' The latter sets the basis to address the first critical question on the views of ECD practitioners and trainers on the value of mathematical literacy to practitioners. Various key themes emerged from the data and are captured in terms of the value of mathematical literacy at a personal, professional and societal level.

Before examining the value in the three contexts described above, I thought it will be useful to address the meanings practitioners constructed of mathematical literacy vs mathematics.

#### **4.2.2 Mathematical literacy vs mathematics**

Mathematical literacy in the literature study revealed that there is a difference between both subjects. Mathematics has always existed as an academic discipline in various societies. However, there exists neither a universally accepted definition of numeracy nor an agreement about its relationship to mathematics argues (Gal & Schmitt, 1994; Curry, Schmitt & Waldron, 1996, cited in Tout & Schmitt, 2000). The authors suggest further that numeracy which is comparable to mathematical literacy has only recently being added to the vernacular in United States. In South Africa, mathematical literacy was introduced as subject matter in its own right and made compulsory for an FET Certificate. Mathematical literacy, it is argued, is crucial for all citizens to function effectively at all levels in their lives. Tout & Schmitt (2000) conclude that most people today need a range of mathematical skills ..... and it is much more than being able to add, multiply, subtract and divide with numbers...it is applicable to real life.

There appeared to be some level of difficulty experienced by practitioners in explaining the differences between mathematics and mathematical literacy as revealed by the following statements obtained in the practitioners written input which was part of the ice breaker used prior to the focus group interview:

Mathematical literacy was defined by four practitioners as

*is to understand about maths*

*it is to understand language of use in children literacy*

*it is knowing about maths*

*it is where you understand the language of numbers*

The above responses indicate the practitioners immediate link of mathematical literacy with mathematics. One practitioner related it to the concept of 'literacy', revealing apparent confusion of the term literacy.

On the other hand, six practitioners demonstrated some understanding relating to mathematical literacy and its application.

*It will help the ECD practitioners to manage the administration control in the ECD site. It will help us to do our budget, for the ECD site. It will help us in measurements and calculations. Mathematics literacy is needed to introduce to the practitioners.*

*my understanding about mathematical literacy is that it is the subject dealing with numbers. As we are living things, surrounding our environment is basically on mathematical literacy, counting, adding, dividing and multiplying is part of our lives on daily basis.*

*mathematical literacy, it is when you use figures or numbers anywhere in your house/home and at school or ECD sites.*

Two practitioners found difficulty in expressing their thoughts

*On my opinion mathematics is bit confusing. Firstly you have to understand what it means. Once you get the meaning you know what it is  
Mathematical literacy is...*

The facilitator defined mathematical literacy as

*dealing with application to life, thinking and logic e.g. measuring a ECD site or developing a budget*

Mathematics, on the other hand, was defined by the 8 practitioners as:

*mathematics it is where you just do what you are given and give out answers  
counting x2*

*refers to science of numbers-right angle = 90*

*It's about calculation, measurements and solving math problems*

*is when you apply numbers, measuring things, when you use figures*  
*is understanding language of use in mathematics to count, multiply and adding*  
*it is giving knowledge of counting the things like in my family when I am going to buy*

The issue of numbers, counting and calculation was linked to mathematics. The last response linked to some understanding and contextualization of mathematical literacy. This appears to be in keeping with the more formal approach view generally held by people when the word 'maths' is used .

Two practitioners did not respond.

The facilitator defined mathematics as:

*it's about formulas, calculus, theorems, rules*

The responses from the practitioners revealed that at the end of the training programme, practitioners were not in a position to explain the official meaning of mathematical literacy and mathematics clearly as well as the basic differences between them. What emerged was common sense perception related to personal experiences of the concepts, which includes to a small degree practical application at the workplace. In this context, practitioner's responses can be viewed in the light that mathematical literacy is a fairly new concept in South Africa. The more commonly word used was numeracy. The confusion between mathematics and mathematical literacy seems to suggest that advocacy may be needed given that mathematical literacy is a new area, and forms part of the compulsory component of the FET Certificate (SAQA, 2001a).

## **4.3 THREE DIMENSIONS RELATED TO MATHEMATICAL LITERACY**

### **4.3.1 Mathematical literacy and personal empowerment**

The mathematical unit standards states that one purpose of the unit standard is for the learner to use mathematics in the management of the needs of everyday living to become a self -managing person (SAQA, 2001c).

Working through mathematics education, according to Bopape, (1998) is one of the main routes to success as in the past mathematics more than any other subject, served as a gatekeeper towards the 'green pastures' for which the majority was not meant, according to Vervoerd, former Prime Minister during the apartheid era in South Africa.

The following statements demonstrate the value of mathematics in the practitioners personal life:

*its helped me in my budget, I do the budget before I get the money so I now how much I will spend from the money I will get*

*in the kitchen I did not know that I should involve my child, she is in pre school, so now I know I ask to bring two onions for me she will go and bring two onions, so she know this is two, three*

*the other day I received a letter from overseas where they are offering me a job where I was supposed to pay a sum of money before sending my form so they required me to pay 139 dollars and I was not aware that I had to convert the dollars to rands. ...i thought that this 139 dollars was easy, ... as time went on I realized that this money needs to be changed ... so foreign currency its helped me a lot,... it's a lot a money I have to pay, on my side I thought it was a small amount of money to pay but it cost close to two thousand rands or so. So I did not send the form*

The practitioners also explained that mathematical literacy increased their self confidence and personal growth as they were able to do calculations on their own, plan and implement a budget and were confident in working with mathematical activities with their children at their ECD site.

*I am able to do monthly budget and do measurement in my cookings*

From a personal empowerment context, practitioners found that they were using mathematical literacy on an informed basis and this is revealed in their preparation of a monthly budget at home and the use of volume and measurement in cooking. Secondly, the learning has impacted on their child rearing practices as two practitioners drew attention to consciously using practical situations to teach their children about numbers. Thirdly, the issue of interpretation and conversion of currency was used to make personal decisions. The latter supports the purpose of the unit standard i.e. that of promoting self management (SAQA, 2001c).



#### 4.3.2 Mathematical literacy and professional development

The mathematical literacy unit standard purpose envisages that learners will use the understanding of mathematical applications in occupational experiences and thus develop into contributing workers (SAQA, 2001c).

The practitioners explained the benefits in the context of ECD as:

*to me, adding, dividing, subtracting and multiplying is very important because if I am dealing with numbers I have to understand these points to be able to teach my children.*

*if I come across for a donor who wants to donate with USA dollars I know what it will be in rands.*

The facilitators were of the opinion that mathematical literacy was necessary for ECD practitioners as they are teaching children. In order for children to grasp basic numeracy, the ECD practitioner has to have some expertise in this area.

*the main thing is that they will know how to apply their knowledge in a practical way*

The practitioners were able to explain using examples as to how mathematical literacy was used in the ECD site from the perspective of the practitioner and children:

*in the block area, measurement is very important, there are a lot of boxes in different sizes, when they built houses, for them it was interesting...*

*but it's a start to mathematics as they are learning about sizes, shapes and so on*

*if you are making a first aid box or a toy you have to measure e.g. the paper you are going to cover the box with*

*I draw up a monthly budget like (e.g.) monthly earnings is R5 500, payment (electricity, R700.00, water – R150.00, groceries – R 1 400, telephone – R100.00, children's transport – R240.00 what will be the expenditure = R 2 350.00. Income minus expenditure R 5 500.00 – R 2 350.00 = R 3 150. I'm left with R3 150*

Practitioners expressed the importance of mathematical literacy in ECD as follows:

*you need it when you are starting site*

*to teach grade R you need numeracy skills*

The above statements by two of the practitioners demonstrates that they do have insight that mathematical literacy is valuable for them to start an ECD site and to facilitate teaching of mathematics to children as revealed by policy requirements. This positive response reinforces the need for practitioners to have a background in mathematical literacy. In this context the Revised National Curriculum Statement recommends that for the foundation phase, children are expected to know for example: numbers, operations and relationships, the teachers should amongst others give the learner opportunities to work with number cards...to recognise, read, write, count and order numbers (Doe, 2002). Secondly, the draft Guidelines for Early Childhood Development Services requires that for registration of an ECD site, a practitioner will have to fill in an application form that requires an understanding for example of measurement and the use of measuring instruments i.e. 'each child must have enough space to move about freely, this must be 1,5m of indoor space and 2m<sup>2</sup> of outdoor play space per child' (Department of Social Welfare, 2001).

One practitioner responded differently in her written input (part of the icebreaker exercise)

*i don't like mathematics at all; it has no meaning to me*

In following up the response in the focus group the researcher gauged that the mathematic teacher in the secondary school that the practitioner attended used to rap their fingers with a ruler when they did not know an answer. This appeared to have contributed to her dislike for maths which culminated in her stopping mathematics in grade 10. Bopape (1998) argues that this form of humiliation as a result of rote learning contributed to mathematics been seen fit for certain people, which is also acknowledged by Pandor (2004).

Clearly, in the context of ECD, practitioners have to have the necessary background in mathematical literacy to enhance children's learning as well as facilitate the functioning of an ECD site. Research conducted reveals that early learning contributes to successful later learning (Williams & Samuels, 2001), in this context it makes learning mathematical concepts enjoyable and can serve to attract 'students' to this subject matter in their later life.

The latter becomes more important for girls who are generally not encouraged to learn 'maths'. This is supported by Pandor (2004) who articulates that 'we need to embed an understanding and love of maths at an early stage'. Finally, it can contribute to avoiding, in Bower's words the 'maths anxiety' syndrome (Bower, 2001).

It was interesting to note that, albeit unconsciously, practitioners were conscious of the effects of rote learning as captured by one practitioners comment on the impact of mathematical literacy on their children at the ECD site:

*what I have noticed that our children at the beginning of the year, they can count from 1-10, but toward at the end of year they could count up to 20...  
to me it was a bit of a surprise,... most of the parents know they use to come and tell me e.g. our children are able to count ...  
then we realize it means we are doing something that we have received from training*

Upon probing the issue of rote learning, the following response was received:

*we don't teach them orally, but there are some teaching aids we use, we teach them practically, for example one block, two blocks so we don't just say it*

From the perspective of the practitioners, the value of mathematical literacy in their work life has been a positive one, both from a perspective of teaching and management of an ECD site. The issue of applicability seems to be a key factor that enhanced their understanding, as they were able to apply their learning at a personal and professional level, which is evident from the examples provided.

#### **4.3.3 Mathematical literacy for citizenship**

The third dimension mentioned as part of the purpose of mathematical literacy is the ability to voice a critical sensitivity to the role of mathematics in a democratic society and so become a participating citizen (SAQA, 2001c). This is in fact a key national strategy of the education system given that mathematics has for a long time been a preserve of a select few (Pandor, 2004; Bopape, 1998).

In terms of the value of mathematical literacy as a citizen, practitioners articulated to issues relating to the purchase of shares, understanding the currency differences and value but there was a limited understanding on using mathematical literacy from a political perspective.

No data was received on the value that mathematical literacy could have on examining for example issues through the lens of social justice. The researcher also noted that whilst there was some content in this regard in the training manual, there does not appear to be concerted effort to highlight the significance of mathematical literacy from the point of view as a citizen of democracy for example in using the vote wisely, understanding the figures used in politicians speeches and raising questions. This is an area that deserves more attention especially given that the aim of mathematical literacy is to develop critical thinkers and promote equity. This issue is also significant in that mathematical literacy is seen as an empowering tool, which is a key principle for the ECD practitioners who remain disadvantaged in terms of status, resources, and power relations. The goal of equitable mathematics education is to equalize outcomes for all students regardless of their race, ethnic heritage, gender, disability, class, or learning style (Frankenstein, 1998).

Tout & Schmitt (2000) sum the need for mathematics at the personal, professional and community level when they state that mathematics should be a tool accessible to all members of society. Adult basic education should be less concerned with school mathematics and more concerned with the mathematical demands of the lived in world... demands that adults meet in their roles as workers, family members and community members.

#### **4.4 INTERROGATING THE MATHEMATICAL LITERACY CURRICULUM**

In this chapter, I will be focussing on critical question two, which addresses the mathematical literacy training delivery in terms of context, learning and teaching strategies and assessment procedures. Socio constructivist theory will inform this section.

##### **4.4.1 Contextualisation**

The FET Policy articulates clearly that 'it should be possible to achieve the mathematical literacy outcomes in a variety of learning contexts.... and must take into account the particular needs of all stakeholders' (SAQA, 2001a).

In ECD the majority of practitioners are black women, disadvantaged in terms of their status as black women and marginalised in terms of ECD not being recognised. The majority come from impoverished communities (Williams & Samuels, 2001).

The following comment by the trainer is indicative of the importance of learner's needs and contexts as key to successful facilitation of the mathematical literacy-training programme.

*this is what makes a difference in facilitators, somebody that comes in stone cold to somebody who understands the background of their students. You have to know their background, where do they come from, what is their knowledge level. That is why on their first day, I introduce myself and get them to introduce themselves, where do they come from*

The above response resonates with the view expounded by Nieto (1999 cited in Singh, 2004). The lived experiences of learners, their background, homes, and cultural diversities are important to make teaching a success. The most effective teachers are those who make a concerted effort to connect learning to the learner's background, which is part of the theory of socio constructivism.

#### **4.4.2 'Use isizulu, where possible, if your learners are English second language speakers'**

There is no doubt that the language of teaching is crucial. Learners develop best when using their main (first) languages for learning argues Tonder (cited in Singh, 2004). In many countries there is no choice as the choice of language is a political decision. In South Africa with 11 languages legislated, this becomes a greater challenge. This is also a challenge for Africa and Asia as reflected by Orton *et al* (1994). Orton *et al* (1994) report that in the 1960s and 1970s a major focus of concern among mathematics educators in Africa, as shown by the reports of the seminars in Lesotho (National University of Lesotho, 1981) and Kenya (UNESCO, 1974) on mathematics and language, was the absence of an adequately mathematical register in the first language. For example, in Hausa, the language of much of Nigeria, there was no word for triangle. In Sinhala, the language of Sri Lanka, there was only one word for all four sided shapes, and in Swahili, a major language of instruction in East Africa, there was no word for diagonal.

Orton *et al* (1994) makes the point that, interesting though this approach may be, it has two weaknesses. First, it is all very well for an academic body to create words but quite another to get them into use. Secondly, this approach focuses on the need for expanding the mathematical register rather than on the analysis of the educational and learning needs of the learner. The following responses from practitioners capture the tensions of the author:

*no, I don't think it should be taught in Zulu as it is more difficult and sometimes there is no Zulu word for certain concepts, I think it should be in English.*

*the facilitator should know both languages of English and isiZulu*

What would the implications for further tertiary learning if IsiZulu, for example is used solely in teaching? Will this contribute to marginalizing practitioners when they proceed to tertiary education? The second challenge is the lack of trained facilitators in mathematical literacy (AMESA, 2003). The issue then maybe is the training of mathematical literacy facilitators, the issue of language will need to be considered in this context. There appears to be a need for further dialogue and research on this issue, given that for a L4 qualification, practitioners are supposed to know two languages as stipulated in the FET Policy (SAQA, 2001a).

#### **4.4.3 Teaching methodologies**

Teaching methods in the past had a negative effect on the teaching of mathematics in South Africa. Drill work was and is still considered as the best way of teaching mathematics. The traditional and ubiquitous whole class teaching method which has become known as transmission teaching has been fairly categorically rejected by many constructivists as been ineffective as a teaching method. Constructivism is certainly been interpreted as advocating discovery and inquiry based learning, incorporating opportunities for discussion and the negotiation and exchange of ideas (Orton *et al*, 1994).

*I liked the way he explained measurement and shares, he took time and asked us questions*

*I enjoyed the way he taught us how to use a calculator....now I am able to calculate percentage*

Policy documents emphasise that the learners pace and background must be taken into account for learning to be really effective and given that mathematical literacy is new, this principle should be noted in facilitating training (DoE, 1997).

*we need more time ,not to be rushed because our minds are not the same  
everything was happening so fast because of the sort time  
facilitator must have understanding of ECD as well*

The comments above details the practitioners appreciation that not all practitioners are the same and that careful thought needs to be given to the structure of the training programme. Secondly, there is a recommendation for the facilitator to have ECD experience as well as mathematical literacy experience which implies the need for contextualisation in the training.

#### **4.4.3.1 Group work assists in problem solving**

In terms of the best teaching methodology, group work was reiterated as being positive by both practitioners and the facilitators. Data obtained from the focus group interview indicated that the reasons for this was that it was easier for the trainer to observe practitioners dialogue, it promoted the sharing of ideas between practitioners, those that did not understand could ask questions and support was provided by peers, and practitioners could speak in isizulu if they preferred it. Some responses taken from the evaluation forms in response to what training technique was enjoyed:

*the way he used to train more especially when it comes to group work  
we could ask questions and get answers in groups*

Groups are known to throw up more hypotheses when problem solving than individuals, suggests Wall ( in Torbe & Shuard, cited in Orton *et al*, 1994). Group discussion, thus performs a scaffolding role. Vygotsky (1978) drew attention to the difference between what pupils can achieve when working on their own and when problem solving under adult guidance or with more capable peers, thus emphasizing the effectiveness of the scaffolding role of discussion. Within the group situation it is claimed that pupils learn to listen to each other, to take turns, to value each other and to receive criticism (Orton *et al* 1994).

Horsley (2003) argues further that teachers who embrace the complexity of teaching organize activities in which students do much of talking and doing, often in small groups without the teacher. They watch student's actions and listen carefully to student's arguments and explanations in order to understand what sense the students are making. When they intervene, they frequently do so by opening the topic up in ways that elicit more questions rather than prompting premature closure.

Adler ( cited in Bopape, 1998) argues further that gender domination is also undermined since research suggests that girls function positively in cooperative learning situations, it is a far cry from the passivity and alienation that has been produced as part of the South African apartheid system of education.

#### **4.4.3.2 Going beyond the dry facts!**

It is important that trainers teach mathematical literacy beyond facts and figures so that practitioners can understand the background to issues and begin to understand the value of learning mathematical literacy, as mathematical literacy can be a powerful tool to examine societal injustices. Abstract teaching can lead to rote learning, lack of understanding or frustration as revealed by one practitioner comment:

*balance of payment...this one was so hard ...even in my test I did not do well in this*

From the above example the trainer needed to clearly articulate why the issue of the country's budget is important to understand from the perspective of personal, professional and societal level and appropriate examples and simulation activities could have helped the practitioner to understand. This is supported by Bopape (1998) who argues that students should look beyond the information provided- story behind the figures e.g. why is there a disparity between spending on education between the different race groups, what are the implications in terms of quality of delivery, resources, what could be done, what is the best way to present this data graphically. Through such questions, Bopape (1998) contends that students may begin to relate mathematical concepts to their daily lives and begin to look at newspaper graphs with greater interest. Thus mathematical literacy can become a powerful tool for examining social issues. The author further suggests that the underlying context for critical mathematical literacy is 'to read the world'. To accomplish this goal, students need to learn how mathematical skills and concepts can be used to understand the institutional structures of our society e.g. understanding different kinds of numerical information e.g. percentages, graphs, using calculations to follow and verify the logic of someone's argument and thus be in a position to question the issues. The latter is captured in the standards as 'the ability to voice a critical sensitivity- in a democratic society and so become a participating citizen' (SAQA, 2001c).

In studying the examples used to relate the national economy to ECD, relating the national budget in terms of the budget allocation and its implications for the children was used. It appears that perhaps that not enough was done as practitioners found this area difficult to understand.



Thus critical interrogation and contextualization in respect to the value of the subject matter is a key principle in the teaching of mathematical literacy. This also lends itself to the purpose of mathematical literacy unit standard.

#### **4.4.3.3 Assessment for positive reinforcement**

In the mathematical literacy training programme, a number of assessment instruments were used such as assignments, practical tasks and tests. SAQA policy on integrated assessment (2004) describes assessment as a structured process for gathering evidence and making judgements about an individual's performance in relation to registered national standards. The policy underlines the importance of assessment to support learning.

To the question as to what they considered their best assignment (written task) the following responses emerged:

budget (draw up a cash buget for your ECD site for the next 3 months based on the following projections...)

measurement (e.g. measure the perimeter of a square with one side being 5m)

Reasons articulated for the above response by the practitioners was because they understood it, they enjoyed it, and could apply it in their ECD sites. The facilitator also corroborated with the latter reasons as revealed by his comment:

*related to something they understood*

The above corroborates with content relevancy and application to practical settings as articulated by the mathematical literacy unit standard.

#### **'Tests were the best form of assessment'**

*had to do it myself*

*because that is where you get the knowledge, cannot ask the trainer or student, therefore it is my work,*

The portfolio of evidence revealed that 87% was the highest percentage received for the summative knowledge test with the lowest being 20%.

With regard to the issue of testing to declare final competency, the facilitator indicated the following:

*tests are a true reflection of knowledge and skills gained to date, there is less chance of copying, there are no referral to notes, their own knowledge comes into play for this subject, the test as a form of assessment for mathematical literacy is good to determine competency*

I question the value of tests as a tool to declare final competency as has it has received criticisms in that it could memorised formulas put into paper. Adler (cited in Bopape, 1998) notes that authoritarianism and rote learning nurtured the view that mathematics was an unalterable body of truths, that all the learners had to do was memorise...and reproduce them in tests and examination. Questions in tests to a large extent remain a meaningless set of questions that have not much bearing on student's lives, or that of the people in the environments in which they find themselves.

The second challenge in respect of assessment relates to second language English (ESL) speakers who may have difficulty in putting their thoughts on paper. ESL students don't always have the words to write down but they definitely have the ideas, sometimes we let them talk before writing states Acquarelli & Mumme (cited in Horsley, Stiles, Mundry & Hewson, 2003). The authors also imply the need to take into account the needs of the learner, which is a principle of constructivism.

The latter is further justified by the comments made by the co-facilitator of the training provider where the study was conducted. The co-facilitator reported that of the thirteen of the 37 students that were declared 'not yet component', some chose not to write the final competency test as they 'felt scared' of failing, others dropped of the programme. The same facilitator pointed that some learners who were second language English speakers found the questions difficult to interpret and this perhaps could be another factor in them' not achieving competency'. This is also borne out in the international study on mathematics, (South Africa was one of the countries that participated) and reported by the HSRC (2000) 'pupils who study mathematics in their second language tend to have difficulty articulating their answers and had difficulty comprehending questions.

Given that the facilitator has had training in the drill method, which emphasised rote learning, it is questionable as to whether the test should be given such a high priority to declare final competency. In declaring final competency, SAQA recommends that a combination of assessment strategies be used in line with the OBET methodology. (SAQA, 2004).

The second form of assessment that the practitioners found positive was the assignment, this was corroborated by the facilitator with the following reasons:

*had a lot of time to do it*

*it was practical*

*could refer to notes*

*discuss with peers and lecturer*

*demonstrated individual strengths, areas of weaknesses, areas that needed attention*

On the other hand, some practitioners also stated that the assignment was not the best to declare competency as there could be an element of 'copying' taking place and learner's status of competency may therefore not be correct.

#### **4.4.3.4 Facilitator challenges**

From the perspective of the facilitator, the following were noted as challenges:

use of english as the main medium of instruction as the practitioners were english second language speakers

absence of embedded knowledge (knowledge base required) and learning assumed to be in place (NQF L 3 requirements) not given attention by the training provider

practitioners lack of mathematical experience at secondary school

for certain concepts, could not find the equivalence in Isizulu

The facilitator raised the issue of lack of embedded knowledge and implications in respect of training time and understanding of content. The mathematical literacy unit standard spells out the embedded knowledge that a learner is expected to have. In practice, due to the apartheid education system, and due to the 'fear of mathematics', many learners did not undertake mathematics at Grade 10 – 12. Thus, it is crucial that the learning assumed to be in place be given serious attention in terms of entry requirements or for recognition of prior learning (RPL) purposes. Not paying attention to this issue could lead to "failure" not because learners did not understand the standards but that they **lacked basic understanding and embedded knowledge**, captured in the following statements by the facilitator:

*what amazed me is that the practitioners had limited or no knowledge when it came to using a scale and measuring children's height*

*they did not know how to use a calculator*

*measuring a pencil was a problem*

*they did not know about VAT*

The implications for training providers from the above are that there is a need to apply the policy guidelines in respect of the mathematical literacy unit standards. On a broader level one is also aware that due to the apartheid system of education, the stereotype view that girls were not good in mathematics has resulted in practitioners having limited mathematical expertise, hence the gap in not meeting the required NQF L3 mathematical literacy requirements as required for the National Certificate in ECD. Therefore, there may be a need to initiate skills programmes or bridging programmes to address this gap, otherwise the very people that mathematical literacy is intended for will not materialize.

## 4.5 MAKING MEANING OF MATHEMATICAL LITERACY – RELEVANCY FOR ECD PRACTITIONERS

The unit standard provides guidance in terms of content for mathematical literacy in terms of specific outcomes, assessment criteria and range statements. It therefore becomes incumbent upon curriculum designers to develop the curriculum, taking into account the FET policy, the mathematical literacy unit standards and needs of the stakeholders, which then allows for contextualisation. I will address the third critical question on the content relevancy and the practitioners views on mathematical literacy being in the ECD qualification.

### 4.5.1 Content

From the group interview, I found that the practitioners saw relevance of content where they were able to apply it in a practical setting. The practitioners saw issues relating to budget, currency, measurement, and data handling as important. This is supported by the following statements when asked what did you enjoy?

- *knowing how to draw a budget*
- *calculating simple interest*
- *learning of measurement*
- *differences between the dollar, pound, it was new experience for me this currency thing*

This was corroborated by the facilitator who stated that practitioners enjoyed the above as a result of the practical application. This is supported by Knowles (1990), Nebraska Institute for the Study of Adult Literacy(2004) who argue that adults are motivated to learn something to the extent that they perceive that it will help them perform tasks or deals with problems that they confront in their real life situations, they learn new knowledge, understandings, skills, values, and attitudes most effectively in the context of application to real- life situations. Context is therefore critical for understanding and thus for learning, as context gives meaning to learning. The latter is also captured in SAQA's integrated assessment policy (2004).

Practitioners in the focus group interview stated that issues relating to the national economy such as balance of payments and graphs were their worst assignments and this was substantiated further when the noted the following as irrelevant

*probability, as a practitioner there is no need to study this probability*  
*inflation is not so important*  
*calculating compound interest*  
*revenue and inflation*  
*graphs – some are not necessary*  
*formulas*  
*balance of payments*

On observation of the portfolios of evidence, the researcher found that the practitioners found difficulty in completing the assignment relating to balance of payments. They found the whole module on national economy irrelevant, said the facilitator as they considered it abstract and that it had no relevance to their life. The fact that the example used was abstract is key to lack of understanding by the practitioners. Another example of a task used demonstrates the ECD contextualisation taken from the portfolio of evidence i.e. 'study your learner numbers for the past three years, what is your prediction for the next year (in other words, how many learners do you expect at your site for next year?). SAQA assessment policy documents stress the point of applicability (SAQA, 2004).

*what has it got to do with us?*

The above response indicate that the aim of mathematical literacy i.e. that of developing a critical citizen has not been absorbed by the practitioners, this implies that perhaps an orientation session on understanding the aims of mathematical literacy could be useful before commencing with training. From the portfolio of evidence, the highest percentage received for the balance of payment test was 55% with the lowest being 10%. The above issues raised in terms of irrelevancy supports AMESA's (2003) comment submitted to SAQA that there is a need for further debate regarding the selection and organisation of mathematical knowledge, skills and values as appropriate for the different sub sectors.

On a broader level, the generic nature of the mathematical literacy standards can be questioned. Given the range of users, it makes sense that the FET SGB, policy developers for mathematical literacy invite representatives from the key stakeholder groupings to input, thereby adding value to SAQA's principle for a qualification that is 'fit for purpose'. Secondly, the issues of contextualising the unit standards deserves further attention, as well as the level it should be for different sub fields which will affirm the purpose it is intended for and is line with the findings of the mathematical literacy investigation(Hallendorff,2003a).

#### 4.5.2 Contextualization of content

From the documentary analysis of the training manual and practical activities, the principle of contextualizing mathematical literacy within ECD was taken into account, albeit on a limited basis. In this regard practitioners were given tasks to measure their ECD site, develop a budget for their site, games, and interpret graphs relating to ECD spending by government.

From a personal and community perspective, contextualization of examples related to the purchase of shares, interest on hire purchase, developing household budgets.

*I came down to their level where they can equate the mathematical literacy in their everyday life e.g. I used the example of a tavern, they know what a tavern is, how many bottles you need to sell to make a profit (facilitator)*

From the input provided by practitioners in the interview, cultural examples was noticeably absent in the teaching and learning. The facilitator responded that he had not thought about it and on reflection it was a good idea to have contextualized certain content areas by using cultural examples.

Practitioners provided examples of some cultural examples that could be used, such as the concept of paying lobola (similar to the dowry system), Ndebele art as it relates to patterns and shapes, making of beaded necklaces as it related to counting and traditional games. Nelson et al (1993) argues the need to integrate culture into mathematical literacy training. At a fairly obvious though superficial level, to recognize and value the cultural heritage of students helps to build their confidence and pride regarding their background. But, far more important, by increasing the awareness of all children to different cultures, the teacher is helping to overcome the existing deep-rooted Eurocentric bias relating to the origins and practice of mathematics. This view is supported by Bishop (cited in Orton et al, 1994) who contends that all societies exhibit mathematical activity in some form. Clearly this area that curriculum designers need to take note of thereby adding value to learning of mathematical literacy and should could also serve to demystify mathematical literacy as the practical application has been or can be experienced.

#### 4.5.3 Should mathematical literacy remain as part of the ECD qualification?

In light of fundamental learning becoming a compulsory component as of 2002, there was some reservation expressed about its value and whether it could become a barrier to achieving a full qualification by the practitioners. The latter was also highlighted in the mathematical literacy investigation conducted by Hallenforff (2003).

10 practitioners responded positively that mathematical literacy remain as part of the ECD qualification in the programme evaluation forms:

*yes! because it helped our administration in our ECD site. You can't do good calculation and financial records without it*

*mathematical literacy is important for everybody learning things that we do everyday in our lives mostly attached to mathematics. It must remain as a component of fundamental learning.*

*yes, because some students never did this at their high school level because they never get good explanations they thought math's is difficult, but is only about understanding.*

*It should remain the same because it is easy.*

*It should remain because we learnt lot of thing in it so we need it to improve our skills, knowledge, values and attitudes.*

*yes, how we are going to run our ECD site if we are not literate in maths.*

Two practitioners responded that it should not be compulsory

*it is not useful in life*

*practitioners should have choices, can do it later if it is necessary for their careers*

The facilitators were also in favour of the unit standard remaining as part of the qualification but also suggested some type of review of the standards:

*should stay as it will facilitate further training*



*it makes practitioners think*

*it is pitched at the right level although some areas may not be relevant and should be reviewed*

The above second statement reinforces the expected outcome of the mathematical literacy unit standard.

Given that SAQA is the custodian of unit standard based qualifications and whole qualifications, it has the social and political responsibility to consult and take account of its constituencies input:

*continue with it but make it much more easier for those who never done maths before*

It is interesting to note that when the mathematical literacy standards became a compulsory component for the FET Certificate, there was a huge outcry, more so from the training providers and consultants. This is evident in the SAQA commissioned research (Hallendorff, 2002a). However, in implementation, the practitioners as revealed in the above statements have embraced the unit standards in a more positive light. This may also be due to the fact that this group of practitioners did have some experience of mathematics in secondary school and that they did attend secondary school as compared to many others who did not have this experience.

Given the effects of apartheid education, the unit standard on mathematical literacy should not serve as a barrier to achieving a full qualification and hence should be reviewed in its entirety, and in fact should affirm the experiences of ECD Practitioners rather than marginalizing them further. This is supported by the unions who responded to the study on the review of the NQF and the Mathematical Literacy Investigation, commissioned by SAQA (DoE, DoI, 2002, Hallendorff, 2002a).

#### **4.6. CONCLUSION**

Mathematical literacy is a new development in the field of education and training, there is limited research at the implementation level, and hence it is difficult to make solid judgments from this small study. What is clear from the data analysis is that the practitioners do see value in mathematical literacy at a personal and professional level. What was also interesting was that the spin offs in terms of their own learning is being used with their own children. The value of mathematical literacy for citizenship was not recognized widely. At the same time what also emerges is the value of contextualizing mathematical literacy within a personal, working and community life so that the relevance as envisaged in the purpose of the unit standard emerges. There is also a call for the standards to be reviewed in line with the comments about content relevancy, irrelevancy, and inclusion of cultural diversity and ECD examples. Training methodologies, as well as the training of the facilitators deserves attention given that this is a new area within the context of the National Certificate in ECD.

## **CHAPTER FIVE: CONCLUSION AND IMPLICATIONS**

### **5.1 INTRODUCTION**

Early childhood development is historically one of the most marginalized sectors of the South African education and training system (Education Training and Development Practices Sector Education and Training Authority, 2002). The registration of ECD qualifications in 2000 is a step forward for the ECD field. The registered qualifications have presented new challenges for the ECD field, particularly in terms of mathematical literacy being part of compulsory fundamental learning. At the same time, one appreciates the purpose of mathematical literacy in promoting the concept of citizens who can engage with issues in society using a critical stance. For ECD practitioners, completion of the FET certificate provides access to further learning, and may contribute to breaking down the cycle of poverty that marginalizes this sector.

This small-scale study involved one training intervention in mathematical literacy undertaken in the context of the Level 4 ECD qualification. This chapter presents the findings in the context of the three critical questions raised in chapter 1, and identifies issues for further consideration and exploration by policy makers, training providers and other stakeholders.

### **5.2 FINDINGS AND IMPLICATIONS**

In terms of mathematical literacy for personal empowerment, there was a positive response from practitioners. Practitioners, as a result of the learning gained in mathematical literacy, were able to demonstrate how their decision-making skills on a personal level were enhanced. An interesting spin-off was that as a result of their learning, they were able to enhance their own children's learning of mathematical concepts. Practitioners were not able to differentiate between mathematics and mathematical literacy after completing the training programme. Given that this area is new there is a need for more advocacy around mathematical literacy to highlight the purpose and value it holds for all sub sectors in South Africa.

In terms of professional development, the study revealed that the majority of practitioners felt that mathematical literacy was needed to manage the ECD site effectively, and in a teaching role too. There was some confusion concerning the purpose of learning mathematical literacy. Some practitioners thought it was to be applied directly with children in their ECD sites rather than it being background knowledge, skills and values for practitioners for personal development as adults, which could be used in the context of their work.

Applying mathematical literacy practically in the ECD context was, therefore, reported as a challenge. This implies that standards writers of mathematical literacy need to provide more guidance to curriculum designers on the issue of contextualising mathematical literacy for the different sub fields.

The role that mathematical literacy can play in a citizen's life was not fully appreciated by the practitioners. This suggests the need for further advocacy. It also suggests that, providers may need to consider an orientation session prior to the commencement of mathematical literacy training programme, focusing on the value of mathematical literacy in the three dimensions of a person's life, that is, personal, professional and societal.

In interrogating the training curriculum relating to mathematical literacy the issue of suitably trained trainers was highlighted. Suitably trained facilitators in this study implies someone who has ECD and a mathematical literacy background. Such a person will add value in contextualising mathematical literacy within ECD. Training providers may therefore need to train their staff in mathematical literacy, which should include facilitation as well as the design of the mathematical literacy curriculum. This also facilitates the process of offering a full qualification in ECD. The study revealed that the socio constructivist methodology enhanced learning of mathematical literacy. In this regard, contextualizing mathematical literacy using ECD examples and the use of mathematical literacy in the different contexts was also recommended by practitioners.

In terms of assessment, the study revealed that the practitioners found the "test" to be the best form of assessment. This implies that providers may need to address the issue of continuous and integrated assessment with practitioners. Further issues that may need to be explored by providers are programme accreditation to include mathematical literacy and appropriate resources for the effective facilitation of the training programme. This should be seen as part of provider development in the context of quality training and delivery. The Education Training and Development Practices - Sector Education and Training Authority (ETDP SETA) could be approached for support, as the latter falls in the realm of skills development, a focus area of the ETDP SETA.

The study pointed to the importance of taking into account the practitioner's entry-level knowledge of mathematics. Lack of embedded knowledge could therefore become a barrier to achieving a full qualification. Skills programmes or bridging programmes to fill the gaps in learning may need to be considered by providers.

Given that SAQA is the custodian of qualifications, it is part of their responsibility and mandate to take note of the needs of different stakeholders and their contexts. Consultation and review of standards become key issues in this regard. Practitioners have suggested content that adds value to their personal and professional lives. Content directed at the citizenship role such, as the national economy was not well received. More effort may therefore need to be paid to the issue of the contextualization of the curriculum. It therefore becomes incumbent upon SAQA to invite input from different stakeholders on these issues. In particular, issues relating to learning assumed be in place, embedded knowledge and whether mathematical literacy needs to be at the level of the qualification may need to be re-visited by policy makers given that learners in general may not have undertaken mathematics before. Other issues relating to content relevancy for all citizens vs content relevancy for different sub fields, contextual applicability and training of facilitators may need to be considered as this is a new area in education and training. A further issue raised in the study is whether writing of the unit standards on mathematical literacy should be left to mathematical experts or a combined expertise representing different sub sectors, thereby, facilitating contextualization and integration.

Emerging from the study, possible areas for future research could be the language of teaching and learning of mathematical literacy. Whilst resource and training organizations have the choice to facilitate in one of the 11 official languages at NQF Level 4, English appears to be generally selected. An issue for further exploration is the significance of offering communication and language studies at the beginning of the training programme in view of the possibility that it could support the understanding of mathematical literacy and assessment procedures. The relationship of mathematical literacy to the ECD core and elective unit standards for the purposes of integration and contextualization is a further possibility that could be explored in future research.

Finally, the majority of practitioners recommended that mathematical literacy remain part of the ECD qualification as it adds value at a personal and professional level. This response is in line with the broad rationale of the mathematical literacy unit standards, that of developing a numerate nation.

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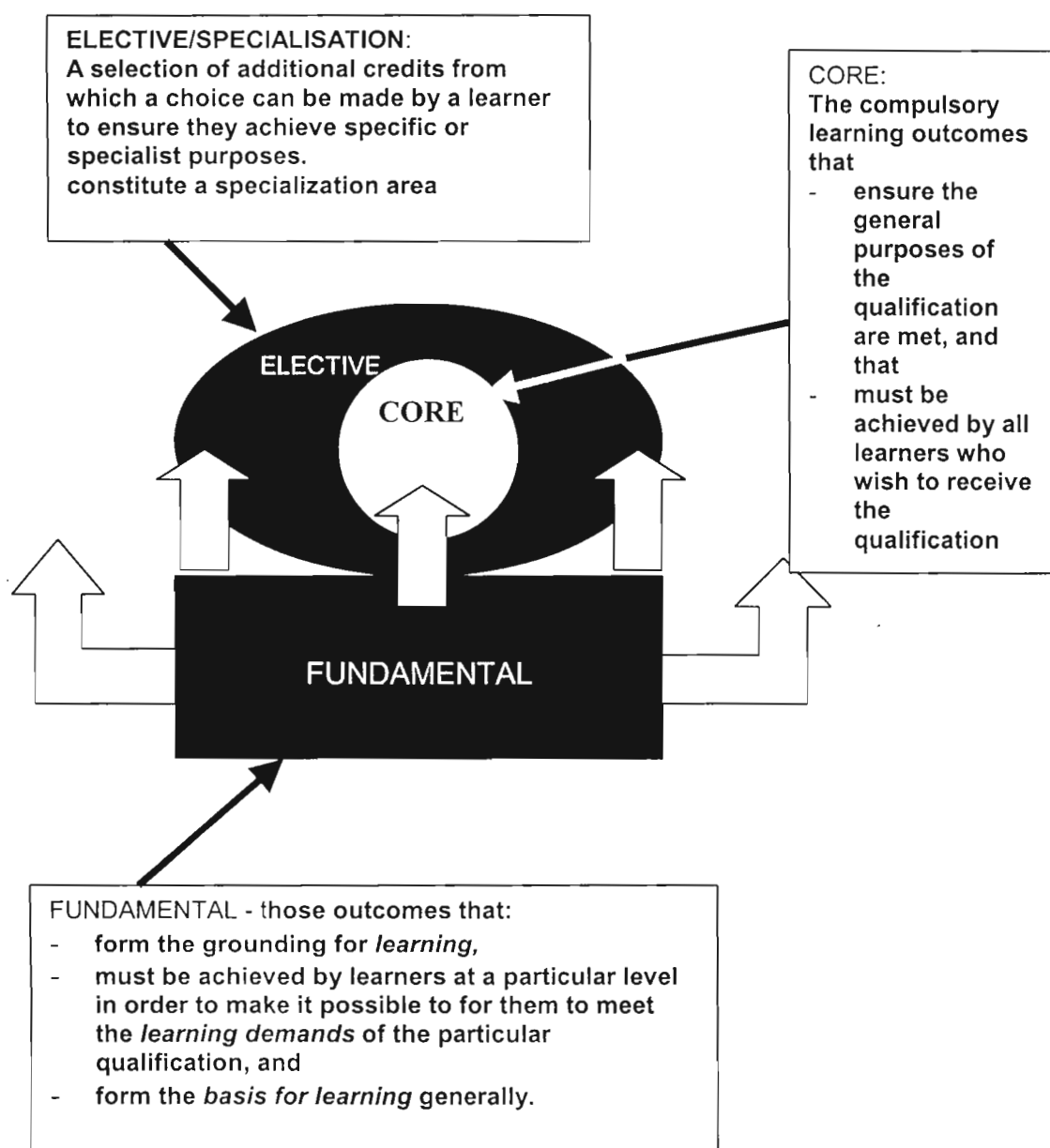
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### Illustration of Fundamental, Core and Elective category of a Qualification

Given that this study revolves around the rules for Fundamentals, (specifically in terms of Mathematics / Mathematical Literacy), the following clarifications and illustrations are provided:



(adapted from Hallendorff, E. (2003a))

### Focus Group Interview Schedule

The following is meant to guide the Facilitator and keep issues on track. It is not meant to be inclusive. After activity 2, questions can follow in any order; the idea is to extract data in line with the research questions verbally, through illustrations and other innovative means. The checks are meant to remind the researchers to capture issues in the context of the research questions.

#### Activity 1 – ‘Breaking the Ice’

Participants will be welcomed and invited to participate in the refreshments provided. During this time they will also fill in a biographical form. This will also serve as an icebreaker making practitioners comfortable and putting them at ease. This will be followed by introductions, purpose of the focus group and the process to be followed and allowing for any questions the practitioners may have.

#### Activity 2

Participants will be given ‘small flash cards’ and asked to capture their understanding of mathematical literacy. Writing their thoughts down allows for reflection. This will be followed by sharing of their thoughts in the group.

#### Activity 3

The purpose of this activity is to determine the participant’s beliefs about what they considered to be priorities in mathematical literacy.

- Participants will be asked to list three areas of mathematical literacy that is vital for ECD practitioners to know at a personal and professional level. These will be written in individual sheets of paper. This will illustrate their personal opinions and first thoughts.
- This will then be collected and reshuffled and given out to each practitioner.
- A chart will be placed on the board with three areas designated important, very important and extremely important for personal and professional development.
- Each person will be given an opportunity to place an issue in each of the designated spaces. This will continue until all pieces of paper are placed. Only two pieces of paper are allowed per area.
- Duplicates will be removed and practitioners will have to negotiate and replace slips of paper accordingly.
- Practitioners will be asked to comment on the group opinion as against their original opinion.
- The facilitator will use this as an opening to the rest of the focus group questions asking why they chose the issue, implications for teaching and their personal development.

(Adapted from Hobden, S. D. 1999).

### **Activity 3 – questions**

#### **ECD Site**

What did you use from your learning of mathematical literacy in the ECD site?

Can you give me some examples that explain what you said further?

How else did it help you in the ECD Site?

Is Mathematical literacy useful for an ECD practitioner? Could you explain using a situation or example?

**Check:** linking theory to practice

#### **Personal**

Has the training helped you personally?

Share some examples with me in what way /what situation

Will you be able to draw/illustrate what you are saying onto paper?

**Check:** linking learning to practical life experiences

#### **Contact training**

Can you tell if the training conducted are similar or different from other education/classes you have attended?

**Check:** non formal/formal similarities/differences

What did you enjoy the most?

Why is this so?

Share with the group a particular example that you have described.

What did you not enjoy?

What are possible reasons for this?

What was the most challenging or the most difficult area in training for you?

What about this that you mentioned that you found challenging?

Can you provide an example/situation that explains this further?

Was the duration of the training programme sufficient in terms of the outcomes of the training programme?

Tell me more.

**Check:** Time and Training

If you had the opportunity to change this situation, what will you do?

Why would you choose to do this in this way?

**Check:** level of involvement/problems

Can you describe what you did in class for a day?

**Check:** teaching methods, participation of learners

Is there any aspect of the teaching you think should be emphasized, why do say that?

**Check:** important area, attitude of learner

#### **Content of training**

Tell me some of the things you covered in the training.

Did any of the content relate to ECD activities?

Share some examples in this regard.

Did any of the content relate to your experiences in daily life?

In what way?

Did you use it in a situation, tell me more?

Did it work?

Describe the situation for me.

Was cultural/traditional subject matter integrated in the content?

Could you describe in what way.

From your understanding of mathematical literacy outcomes, do you think cultural issues could have been used to illustrate examples etc?

Tell me more.

**Check:** link with personal/professional

### **Training manual**

Did this help you with your training, in what way?

**Check:** Level / language

### **Facilitator**

Who was your facilitator/s?

What did you enjoy about this facilitator?

Why is this so?

What did you not like about this facilitator?

Why was this?

### **Preparation**

Did the facilitator bring in charts/posters to the session?

What else did you find that the facilitator used that helped you in or after the training.  
Support

Can you share with me forms of support that the facilitator or the Project offer you?

Was it helpful/not helpful, in what way?

Did the facilitator visit you in your ECD site or give you any tasks that you had to complete at your ECD site?

Can you explain more about this in terms of the benefits, weaknesses etc.

**Check:** style and motivation

### **Language**

What language was used in the training?

How do you feel about this?

Any recommendations on this?

### **Assignments**

What was your best assignment that you completed?

Can you describe what it involved and why you enjoyed it?

Which assignment did you not enjoy, why was this so?

In terms of completing assignments and follow up activities, how did you go about completing it?

Did you encounter problems?

What did you do about it?

Did you seek further help?

Share with us why you found this necessary

How did you go about seeking help?

Were assignments and follow up useful, tell me more.

**Check:** does this expand contact training

### **Assessment**

Give me some examples of the forms of assessment used in the training?

What did you find helped to track your progress and difficulties/

Why do say this?

What was most challenging assessment form?

What was the most challenging assessment activity?

Why was this so?

What form of assessment did you enjoy?

Tell me more about this in terms of the related activity.

What are your feelings on the summative test? Tell me more.

What of the portfolio compilation?

**Check:** value of tests to learner attitude

### **Level of Standards**

Do you believe that ECD practitioners need to know about mathematical literacy?

Why do say that?

What do they need to know?

Why is this so?

How will it help them?

Should it be compulsory?

Why is so?

Is the level it is now i.e. L4 appropriate?

Why do say that?

What level should it be pitched at?

**Check:** perceptions on standards and value

### **Other**

If you had to change anything in the mathematical literacy, what will it be?

Why is so?

Any recommendations for the Project to follow up on?

Why is this so?

Is there anything else you would like to add?

**Check:** expectations, needs, and additional information

[\[Registered Qual & Unit Std Home page\]](#) [\[Search Qualifications\]](#) [\[Search Unit Standards\]](#)

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## SOUTH AFRICAN QUALIFICATIONS AUTHORITY

### REGISTERED UNIT STANDARD:

Use mathematics to investigate and monitor the financial aspects of personal, business and national issues

SAQA US ID	UNIT STANDARD TITLE		
9014	Use mathematics to investigate and monitor the financial aspects of personal, business and national issues		
SGB NAME	ABET BAND	PROVIDER NAME	
SGB for Math Literacy, Math, Math Sciences L 2 -4	Undefined		
FIELD DESCRIPTION		SUBFIELD DESCRIPTION	
Physical, Mathematical, Computer and Life Sciences		Mathematical Sciences	
UNIT STANDARD CODE	UNIT STANDARD TYPE	NQF LEVEL	CREDITS
PHY-MTH-0-MLMMS 2-4	Regular-Fundamental	Level 4	6
REGISTRATION START DATE	REGISTRATION END DATE	REGISTRATION NUMBER	SAQA DECISION NUMBER
2001-10-10	2004-10-10	9014	SAQA 0838/01

### PURPOSE OF THE UNIT STANDARD

This Unit Standard is designed to provide credits towards the mathematical literacy requirement of the NQF at Level 4. The essential purposes of the mathematical literacy requirement are that, as the learner progresses with confidence through the levels, the learner will grow in:

A confident, insightful use of mathematics in the management of the needs of everyday living to become a self-managing person

An understanding of mathematical applications that provides insight into the learner's present and future occupational experiences and so develop into a contributing worker



The ability to voice a critical sensitivity to the role of mathematics in a democratic society and so become a participating citizen.

People accredited with this standard are able to:

Use mathematics to investigate and analyze, regional and/or national budgets and income and expenditure

Use compound growth to make sense of inflationary effects on the national economy

Use mathematics to critique and debate aspects of the national economy

### **LEARNING ASSUMED TO BE IN PLACE**

The credit value is based on the assumption that people starting to learn towards this unit standard are competent in Mathematical Literacy and Communications at NQF level 3.

### **UNIT STANDARD RANGE**

Range statements are provided for specific outcomes and assessment criteria as needed.

### **Specific Outcomes and Assessment Criteria:**

#### **SPECIFIC OUTCOME 1**

Use mathematics to investigate and analyze regional and/or national budgets and income.

#### **OUTCOME NOTES**

Use mathematics to investigate and analyze regional and/or national budgets and income and expenditure.

#### **OUTCOME RANGE**

The mathematical aspects related to the following situations:

Key elements of provincial and national budgets such as gross domestic product, balance of payments, money supply, indices, and tax.

### **ASSESSMENT CRITERIA**

#### **ASSESSMENT CRITERION 1**

1. Regional and/or national budgets from the media and other sources are accessed, and income and expenditure are described realistically.

#### **ASSESSMENT CRITERION 2**

2. Calculations are carried out efficiently and correctly using computational tools.

### ASSESSMENT CRITERION 3

3. Solutions obtained are verified in terms of the context.

### ASSESSMENT CRITERION 4

4. Different ways of representing budgets are critically analyzed and related.

### ASSESSMENT CRITERION RANGE

Representations refer to pie charts, graphs, tables, and formulae.

### ASSESSMENT CRITERION 5

5. Actual income and expenditure is analyzed and compared to planned income and expenditure. Variances are identified.

### SPECIFIC OUTCOME 2

Use compound growth to make sense of inflationary effects on the national economy.

### OUTCOME RANGE

The mathematics related to:

Indices (e.g., consumer price index);

Base rates, rates of inflation;

Interest rates, (e.g. the repo rate, bank rate);

Inflation targeting.

### ASSESSMENT CRITERIA

#### ASSESSMENT CRITERION 1

1. Methods of calculation are appropriate to the problem types.

#### ASSESSMENT CRITERION 2

2. Computational tools are used efficiently and correctly and solutions obtained are verified in terms of the context or problem.

#### ASSESSMENT CRITERION 3

3. Solutions to calculations are interpreted in terms of base rates or indices.

#### ASSESSMENT CRITERION 4

4. Appropriate formulae are understood and used to calculate solutions to problems.

### SPECIFIC OUTCOME 3

Use mathematics to critique and debate aspects of the national economy.

## OUTCOME RANGE

The mathematics to include aspects such as:

Exchange rates;  
Imports, exports;  
Monetary policy;  
The control of inflation.

## ASSESSMENT CRITERIA

### ASSESSMENT CRITERION 1

1. Values are calculated correctly.

### ASSESSMENT CRITERION 2

2. Mathematical tools are used to compare the effects of changes in different sectors of the national economy.

### ASSESSMENT CRITERION 3

3. Critique and debating points are based on well-reasoned arguments and are supported by mathematical information.

## UNIT STANDARD ACCREDITATION AND MODERATION OPTIONS

Providers of learning towards this unit standard will need to meet the accreditation requirements of the GENFETQA.

Moderation Option: The moderation requirements of the GENFETQA must be met in order to award credit to learners for this unit standard.

## UNIT STANDARD ESSENTIAL EMBEDDED KNOWLEDGE

The following essential embedded knowledge will be assessed through assessment of the specific outcomes in terms of the stipulated assessment criteria. Candidates are unlikely to achieve all the specific outcomes, to the standards described in the assessment criteria, without knowledge of the listed embedded knowledge. This means that the possession or lack of the knowledge can be inferred directly from the quality of the candidate's performance against the standards.

Income and expenditure  
Budgetary control  
Taxation  
Percentage, rates, ratio and proportion  
Terminology and definitions associated with financial situations  
Compound increase and decrease  
Estimation and approximation  
Inflation targeting, money supply, liquidity  
Index.

## **Critical Cross-field Outcomes (CCFO):**

### **UNIT STANDARD CCFO IDENTIFYING**

Identify and solve problems using critical and creative thinking: Solve a variety of numerical and financial problems related to business and national budgets.

### **UNIT STANDARD CCFO COLLECTING**

Collect, analyze, organise and critically evaluate information: Gather, organize, evaluate and interpret financial information to plan, critique and make provision for monitoring budgets and other financial issues.

### **UNIT STANDARD CCFO COMMUNICATING**

Communicate effectively:

Use everyday language and mathematical language to critique relationships, processes and problem solving methods in relation to the financial concerns of the adult with increasing responsibilities.

### **UNIT STANDARD CCFO CONTRIBUTING**

Use mathematics:

Use mathematics to analyze, describe, represent and critique financial issues of a national nature and to solve problems of a financial nature relevant to the adult with increasing responsibilities.

### **UNIT STANDARD ASSESSOR CRITERIA**

Assessors should keep the following general principles in mind when designing and conducting assessments against this unit standard:

Focus the assessment activities on gathering evidence in terms of the main outcome expressed in the title to ensure assessment is integrated rather than fragmented. Remember we want to declare the person competent in terms of the title. Where assessment at title level is unmanageable, then focus assessment around each specific outcome, or groups of specific outcomes.

Make sure evidence is gathered across the entire range, wherever it applies. Assessment activities should be as close to the real performance as possible, and where simulations or role-plays are used, there should be supporting evidence to show the candidate is able to perform in the real situation.

Do not focus the assessment activities on each assessment criterion. Rather make sure the assessment activities focus on outcomes and are sufficient to enable evidence to be gathered around all the assessment criteria.

The assessment criteria provide the specifications against which assessment judgments should be made. In most cases, knowledge can be inferred from the quality of the performances, but in other cases, knowledge and understanding will have to be tested through questioning techniques. Where this is required, there will be assessment criteria to specify the standard required.

The task of the assessor is to gather sufficient evidence, of the prescribed type and quality, as specified in this unit standard, that the candidate can achieve the outcomes again and again and again. This means assessors will have to judge how many repeat performances are required before they believe the performance is reproducible.

All assessments should be conducted in line with the following well documented principles of assessment: appropriateness, fairness, manageability, integration into work or learning, validity, direct, authentic, sufficient, systematic, open and consistent.

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### Focus Group Interview

Dear Practitioner

Currently, I am engaged in a research project at the University of KwaZulu Natal mentored by Professor Muthukrishna from the University. The research is concerned with 'exploring the Mathematical Literacy experiences of ECD Practitioners'. I chose this topic, as I believe it will add value to the work of New Beginnings.

As part of the process of data collection, I will be interviewing a group of Practitioners undertaking the Level 4 ECD qualification. As one of the selected participants for the research study, I have taken the liberty of writing to you in order to seek your assistance in acquiring information about your experiences relating to the research study. I will be assisted by Mrs Felecia Maqalika. I also intend to record the interview so that the rich information gained will be appropriately used in the research study. Post the research; it is my intention to share the information with you.

The date proposed for the interview is the 30<sup>th</sup> November and 1st December 2004. Please confirm your intention to participate with Felicia Maqalika who will provide you with further details.

#### Confidentiality

All information will be regarded as confidential and no personal details of any Practitioner/ respondent will be mentioned in the findings, nor will the information provided affect the practitioner's status at the Project.

Thank you for your co-operation and time.

Yours Sincerely

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**Patsy Govender (Ms)**

November 2004